Global Assessment Report
on Disaster Risk Reduction

2022

Our World at Risk: Transforming Governance for a Resilient Future

Summary for Policymakers

United Nations

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Introduction

In the wake of the coronavirus disease (COVID-19) pandemic and the hottest decade on record, there is growing momentum to change how the global community manages risk. Despite commitments to build resilience, tackle climate change and create sustainable development pathways, current societal, political and economic choices are doing the reverse. This jeopardizes not only achievement of the Sendai Framework for Disaster Risk Reduction 2015–2030, but also hinders progress towards the Paris Agreement and the Sustainable Development Goals (SDGs) set out in the Transforming our World: the 2030 Agenda for Sustainable Development (United Nations, 2015a, 2015b, 2015c). To change course, new approaches are needed. This will require transformations in what governance systems value and how systemic risk is understood and addressed. Doing more of the same will not be enough.

COVID-19 and climate change are rapidly making it clear that, in today's crowded and interconnected world, disaster impacts increasingly cascade across geographies and sectors. Despite progress, risk creation is outstripping risk reduction. Disasters, economic loss and the underlying vulnerabilities that drive risk, such as poverty and inequality, are increasing just as ecosystems and biospheres are at risk of collapse. Global systems are becoming more connected and therefore more vulnerable in an uncertain risk landscape. Local risks, like a new virus in Wuhan, China, can become global; global risks like climate change are having major impacts in every locality. Indirect, cascading impacts can be significant. For example, many countries felt the negative economic impact of the COVID-19 pandemic months before ever registering a single case of the disease. Without increased action to build resilience to systemic risk, the SDGs cannot be achieved.

The *Global Assessment Report on Disaster Risk Reduction 2022* (GAR2022; UNDRR, 2022) highlights that:

- The climate emergency and the systemic impacts of the COVID-19 pandemic point to a new reality.
- Understanding and reducing risk in a world of uncertainty is fundamental to achieving sustainable development.
- The best defence against future shocks is to transform systems now and to build resilience by addressing climate change and reducing the vulnerability, exposure and inequality that drive disasters.

GAR2022 explores how, around the world, structures are evolving to better address systemic risk. The report shows how governance systems can evolve to reflect the interconnected value of people, the planet and prosperity. It outlines how actions such as changing what is measured to account for factors such as sustainability, the value of ecosystems and future climate change impacts can have a powerful effect, including unmasking dangerous imbalances in existing systems. Investment in understanding risk is the foundation for sustainable development. However, this needs to link to a reworking of financial and governance systems to account for the real costs of current inaction to address risks like climate change. Without this, financial balance sheets and governance decision-making will remain fragmented and be rendered increasingly inaccurate and ineffective.

CASE STUDY: COVID-19 AND SYSTEMIC RISK

1 INTRODUCTION – REWIRING SYSTEMS FOR A RESILIENT FUTURE:

Myopic thinking meant that, despite warnings and data that a pandemic was overdue, preparedness was inadequate and governance systems across the world struggled to pivot to a new reality.

2 OUR WORLD AT RISK:

Human choices and demographic trends increase the likelihood that hazards like COVID-19 can spread from animals to humans and impact all continents rapidly. Exposure to underlying risk factors, such as high levels of air pollution, unsafe housing or limited access to health services, were found to significantly affect fatality rates.

12 TRANSITIONS TO SYSTEMIC RISK GOVERNANCE:

At the start of the COVID-19 pandemic, assessment of preparedness measures was focused on the capacity of health systems and not on coordination and leadership, yet these turned out to be crucial in effective response and management of a protracted crisis.

11 FROM BIG DATA TO BETTER DECISIONS:

Basic data collection at national and local levels has faced challenges of missing information and errors, but the pandemic has also triggered innovations in the generation, function and use of dynamic disaggregated data.

10 EMERGING APPROACHES TO ASSESSING SYSTEMIC RISK:

The pandemic has exposed weaknesses in the foundations of data and analytics to understand the connections between health systems and socioeconomic vulnerability, at national and international levels.

9 ADVANCING RISK COMMUNICATION:

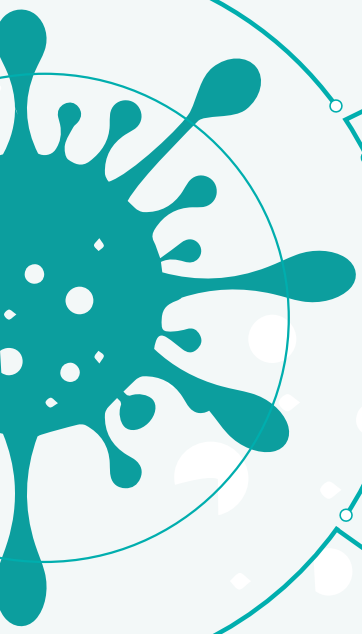
Misinformation and anti-vaccination campaigns reduced trust in public health measures, but there were also many effective scientific communicators in the media and successful collaborations focusing on specific communities.

3 SYSTEMIC RISK AS A CHALLENGE TO SUSTAINABLE DEVELOPMENT:

The systemic impacts of the pandemic have derailed SDG achievements across almost all indicators. For example, using the Lifeyears Index, the economic and social costs of the pandemic in 2020, measured in lifeyears lost, far outweighed the average annual costs of other disasters, and the summed cost of all epidemics from 2000 to 2019.

4 HOW HUMAN CHOICES DRIVE VULNERABILITY, EXPOSURE AND DISASTER RISK:

Although the pandemic has affected all countries and regions, vaccine inequity has seen lower-income countries left behind. The cascading health and economic impacts have been worse for poorer and marginalized communities, women exposed to violence and small economies dependent on tourism.



5 HOW SYSTEMS UNDERVALUE KEY ASSETS AND OPPORTUNITIES FOR LEARNING:

The pandemic has caused fierce debates over what governments and societies should value most (e.g. health or economic activity; restricted movement/mask wearing or "freedom"), and what are acceptable risks (e.g. social protection, mental health, food and income versus infection, illness and overwhelmed health systems).

6 SHIFTING PERCEPTIONS ON RISK:

The pandemic has highlighted the need to recognize that planetary and human systems are interdependent, and that risk knowledge systems need to become more flexible and open to different world-views, including indigenous and traditional perspectives.

7 HOW HUMAN BIASES AND DECISION PROCESSES AFFECT RISK REDUCTION OUTCOMES:

The pandemic saw initial optimism bias ("we will be OK"), impacts of experience/availability bias ("our hospitals are overflowing"), pessimism ("there is nothing we can do"), political polarization ("our group does not wear masks") and "protect my country" versus promoting the global public good of vaccine sharing.

8 ADDRESSING BIASES TO INCREASE INVESTMENT IN RISK REDUCTION:

To encourage social distancing and vaccination, health authorities used regulation and enforcement, appeals to a sense of social coherence ("we are in this together"), fear of loss ("do it for your loved ones") and rewards such as promising to open entertainment venues when a certain percentage vaccination rate was reached.

The report also explores how designing systems to work with, not against, the way human minds make decisions can support accelerated action. Innate biases and mental short cuts can make people's thinking myopic, and prone to inertia, oversimplification or herding when making decisions around risk. These biases are particularly likely to kick in when risks are newly felt, and therefore unfamiliar, as is the case with many systemic risks such as climate change or a pandemic. This helps explain why people, and the institutions they work for, can resist making good decisions about risk, even in the face of clear scientific data.

Reframing risk information, policies and products to present expert risk understanding differently can help overcome this hurdle. Designing in consultation with affected populations, building on existing expertise and local knowledge, and leveraging technology to help support better communication and dialogue around risk can increase the effectiveness and acceptance of change. The "opt-out" rather than "opt-in" risk-based premiums in flood insurance in France, or the innovative communications around safe housing construction during earthquake recovery phrases in Nepal are examples of how this can be done (GAR2022, Chapter 8).

Building on innovations in modelling systemic financial crises, GAR2022 outlines how similar methods are now being applied to better understand the cascading, cross-sectoral impacts of systemic risk on sustainable development. It shows how both developed and developing countries are innovating to improve analytics. Emerging methods better depict impacts in key systems like food, infrastructure and supply chains, which cascade across sectors and geographies. These further drive social impacts such as increased inequality, migration and conflict.

These technological advances are powerful tools in accelerating risk understanding. However, in a world of certain uncertainty, no model can accurately predict what is a fundamentally unpredictable future. Science can help identify positive pathways, test options and find weak points. But it cannot predict across the infinite variables of a complex world. GAR2022 therefore highlights examples where human knowledge and global models are coming together to apply data more effectively to support better decision-making around risk. Local food security projects in Kenya are using state-of-the-art climate information to discuss options for resilient agriculture with local partners. A "deep demonstration approach" is being applied in Viet Nam where innovators and governments are working together to co-design a green circular economy and better understand and address systemic risk. Examples in GAR2022 highlight options to leverage technology, enhance participation and increase the use of local and indigenous knowledge to create the agile, flexible systems necessary to build resilience in today's complex world.

To accelerate essential risk reduction and resilience building, GAR2022 calls on policymakers to:

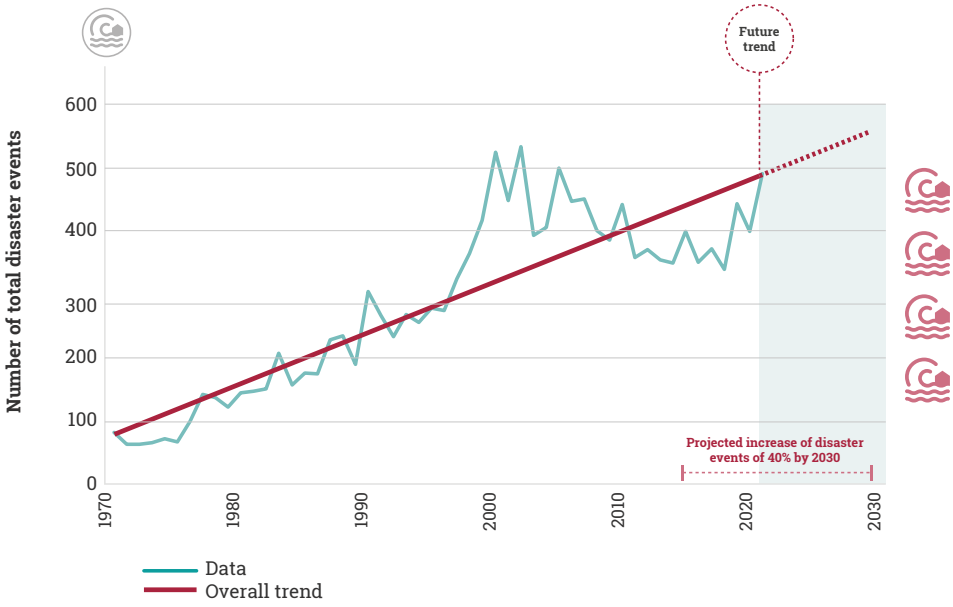
1. Measure what we value.
2. Design systems to factor in how human minds make decisions about risk.
3. Reconfigure governance and financial systems to work across silos and design in consultation with affected people.

The challenge

Human action is creating greater and more dangerous risk, and pushing the planet towards existential and ecosystem limits. Risk reduction needs to be at the core of action to accelerate climate change action and achieve the SDGs. If current trends continue, the number of disasters per year globally may increase from around 400 in 2015 to 560 per year by 2030 – a projected increase of 40% during the lifetime of the Sendai Framework (Figure S.1). For droughts, there is a large year-on-year variation, but current trends indicate a likely increase of more than 30% between 2000 and 2030 (from an average of 16 drought events per year during 2001–2010 to 21 per year by 2030) (Figure S.2). The number of extreme temperature events per year is also increasing, and based on current trends will almost triple between 2001 and 2030 (Figure S.3). Disasters have negative impacts on biodiversity and environmental sustainability.

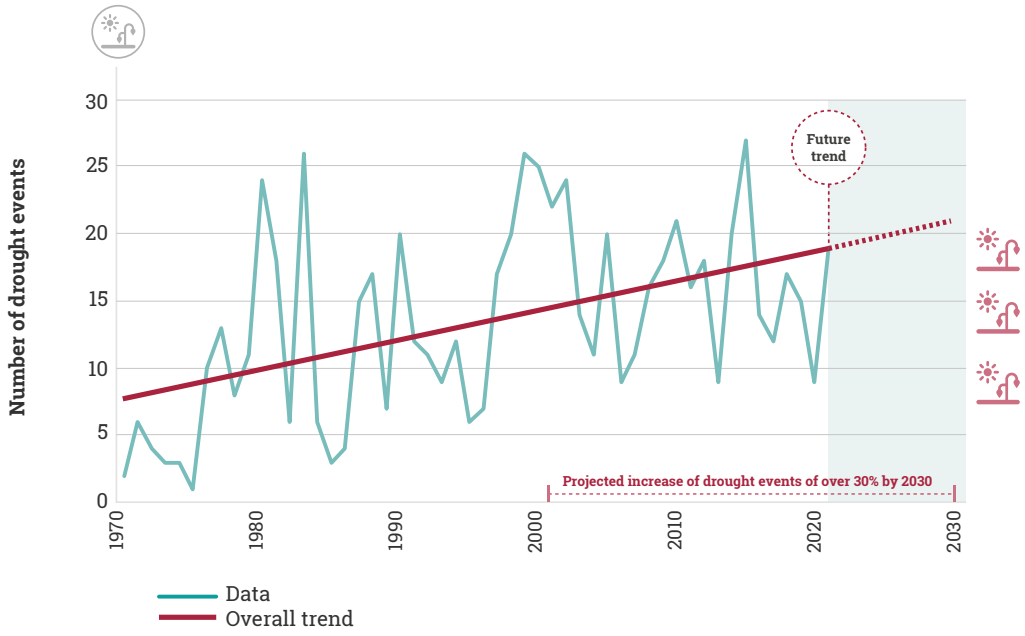
These trend lines do not take into account future climate change impacts, which are accelerating the pace and severity of hazard events, nor the fact that current choices mean the world is set to exceed the Paris Agreement's global average maximum temperature increase target of 1.5°C by the early 2030s (IPCC, 2021).

Figure S.1. Number of disaster events 1970–2020 and projected increase 2021–2030



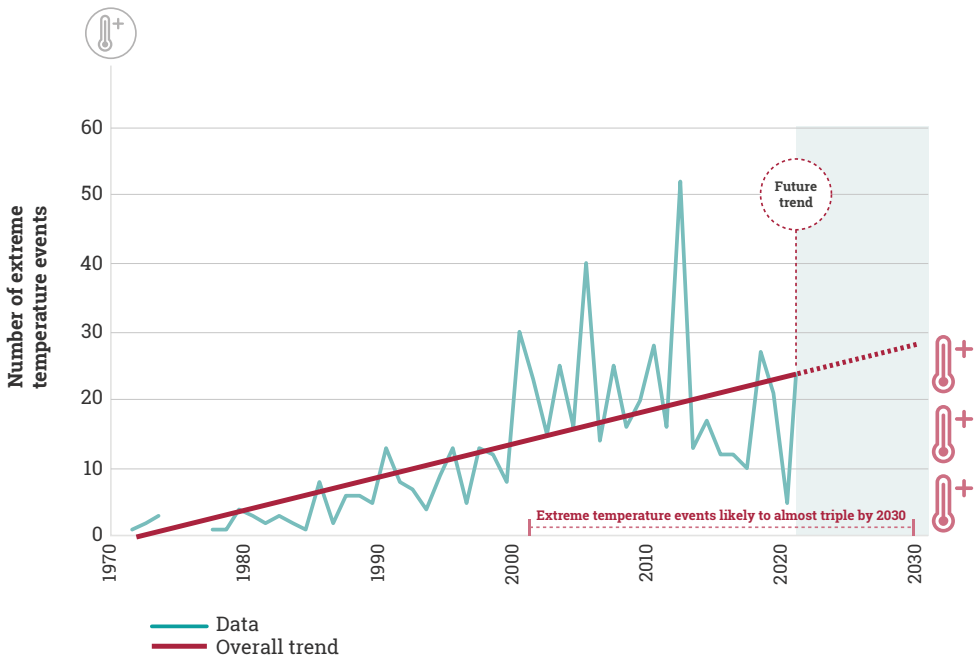
Source: United Nations Office for Disaster Risk Reduction (UNDRR) analysis based on the International Disaster Database (EM-DAT; CRED, 2021)

Figure S.2. **Number of drought events 1970–2020 and projected increase 2021–2030**



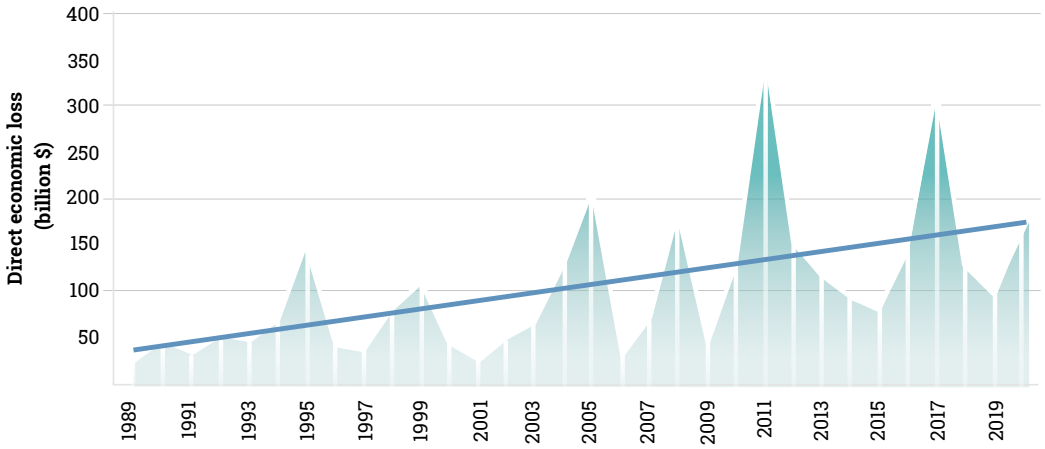
Source: UNDRR analysis based on EM-DAT (CRED, 2021)

Figure S.3. **Number of extreme temperature events 1970–2020 and projected increase 2021–2030**



Source: UNDRR analysis based on EM-DAT (CRED, 2021)

Figure S.4. Direct economic loss from disasters (billion $), 1989–2020



Source: UNDRR analysis based on EM-DAT (CRED, 2021)

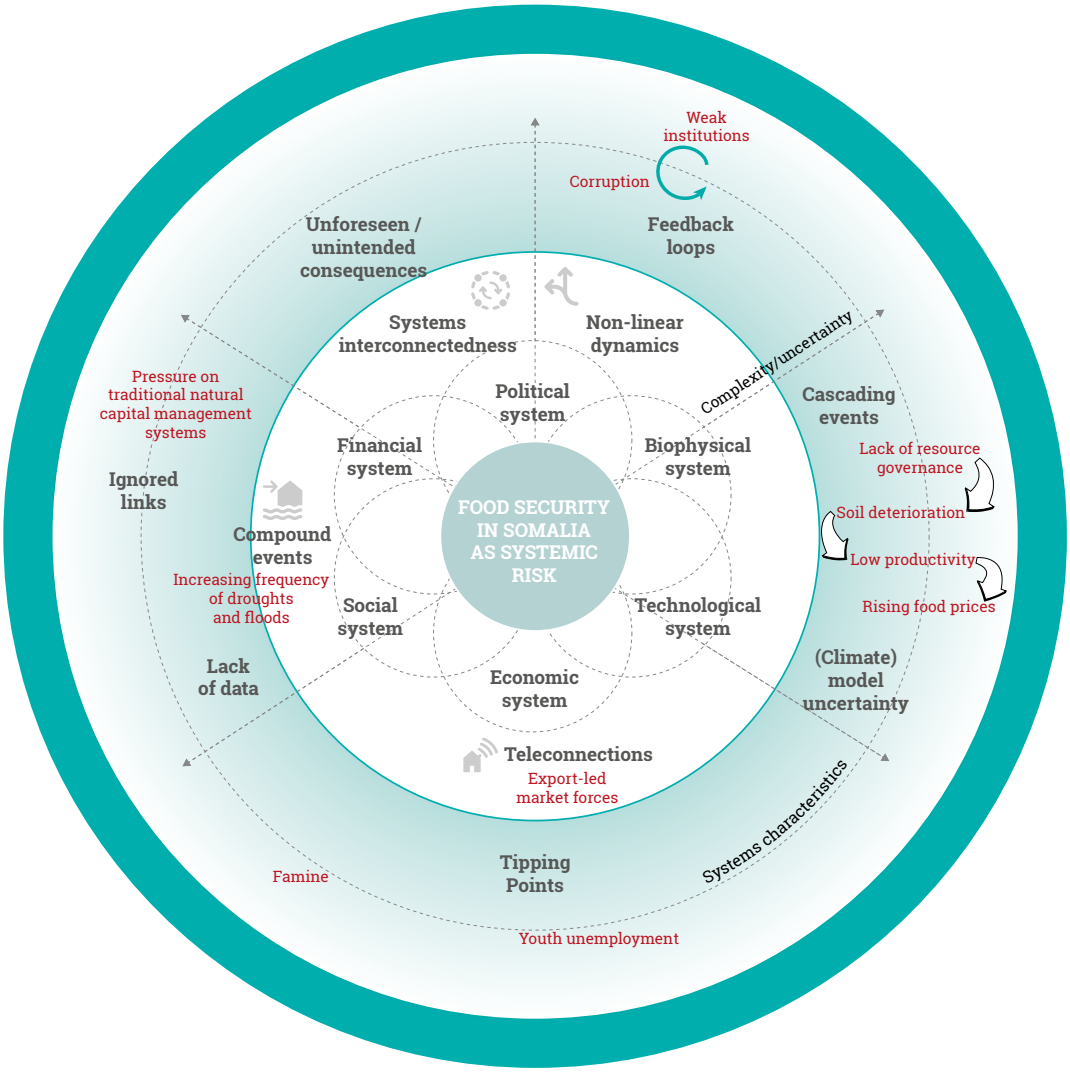
The average annual direct economic loss from disasters has more than doubled over the past three decades, showing an increase of approximately 145% from an average of around $70 billion in the 1990s to just over $170 billion in the 2010s (Figure S.4). However, the impacts of disasters stretch further than economic losses; they also fundamentally undermine social and ecological systems.

Policy and personal action now can reverse this trend, but only if systemic risk is better understood and risk reduction action is accelerated. The fundamental equation that risk is a function of a hazard event combined with vulnerability and exposure has not changed. However, systemic risk occurs in today's globalized world through interconnected digital and physical infrastructures, globally integrated supply chains and factors such as urbanization and increased human mobility. Networks are susceptible to breakdowns, infections and attacks, including from malicious third parties.

For example, the pursuit of ever more efficient food systems has led to greater reliance on trade to fill production gaps or to absorb oversupply. Human choices have led to agricultural systems operating with reduced margins or buffers against unplanned outcomes, making them less resilient. When a hazard event occurs and these buffers are exceeded, disasters occur. The disaster can then have cascading impacts, such as escalating local conflicts, accelerating overexploitation of ecosystems or causing international trade disruption. These effects cascade far beyond the food system, and can have wide effects across social, economic and biophysical systems.

Systemic risk cannot be eliminated entirely, but it can be reduced and addressed more effectively. Addressing systemic risk requires building on existing risk reduction know-how, and also developing enhanced approaches to address the characteristics of systemic risk such as its cascading effects and inherent complexity and uncertainty. The schematic on systemic risk in the Somalian food system outlines food system disruption and cascading impacts (Figure S.5).

Figure S.5. The complexity of food security in Somalia and its inherent systemic characteristics



Source: Adapted from Thalheimer et al. (2022)

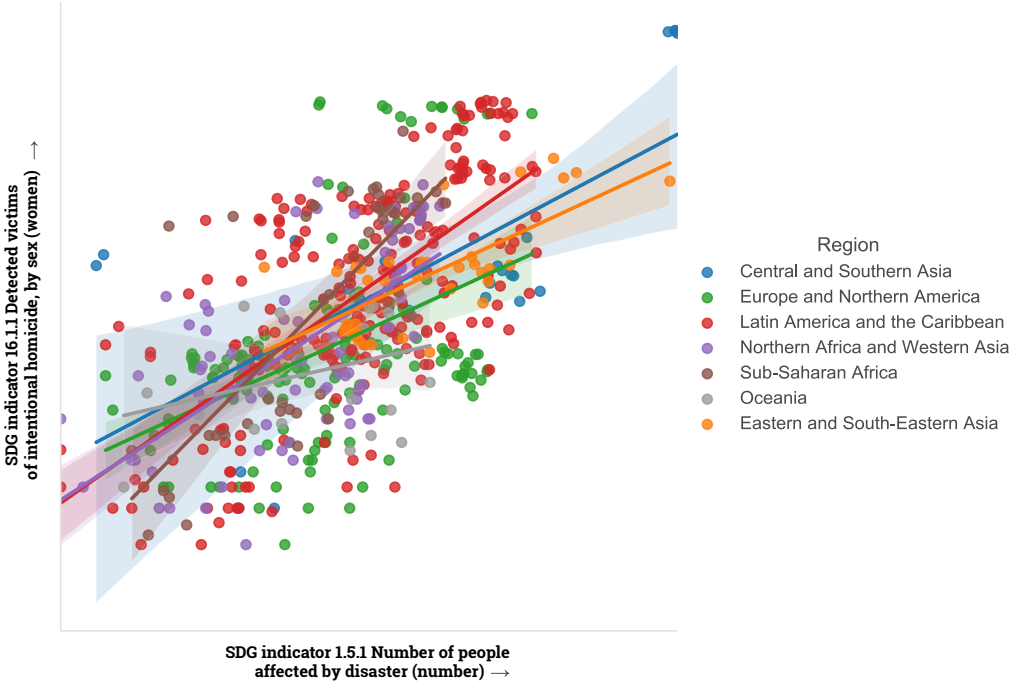
The costs of disasters are felt across almost all areas of sustainable development. As the world urbanizes, risk is being concentrated in densely populated areas, many of which are not designed to withstand their current levels of hazard exposure, let alone those anticipated as a result of climate change.

The indirect impacts of disasters can also have wide-ranging cascading impacts on other aspects of structural or social inequality. For example, research shows that violence against women and girls increases in the aftermath of disasters. At the extreme end of the scale, this takes the form of intentional homicides. Figure S.6 shows how SDG data records a correlation between the number of people being affected by disasters and an increase in intentional homicides of women.

Managing livestock in Hargeisa, Somalia

Credit: © Shutterstock/Free Wind

Figure S.6. Intentional homicides of women and disaster affectedness, 2015–2021

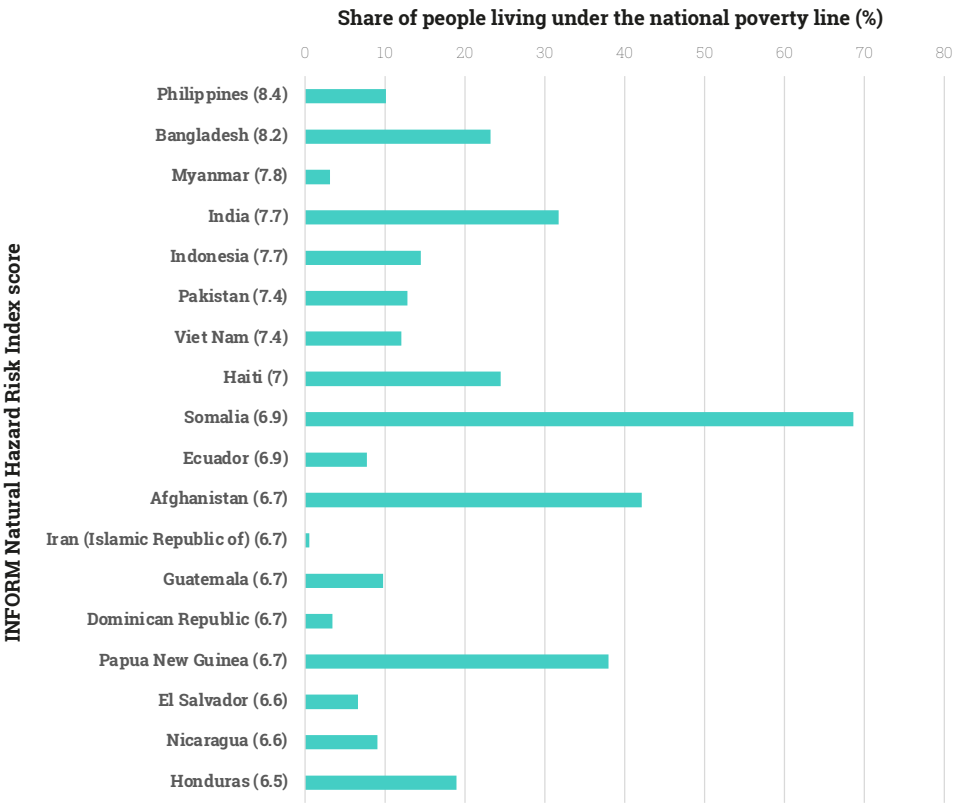


Source: United Nations Department of Economic and Social Affairs analysis based on Global Sustainable Development Goal Indicators Database (UN DESA, 2021)

There is also a strong relationship between poverty and disaster risk. Within high-risk countries, a higher percentage of poor households are exposed to disasters compared with non-poor households (GAR2022, Chapter 2). According to the INFORM Natural Hazard Risk Index, most of the countries that face high disaster risk are also those with a high share of population living under the national poverty line: 18 of the 20 countries with the highest disaster risk are middle- and lower-income countries, and they have an average national poverty rate of 34% (Figure S.7). This compares with a 0.5% poverty rate in the lowest-risk countries (European Commission, 2021).

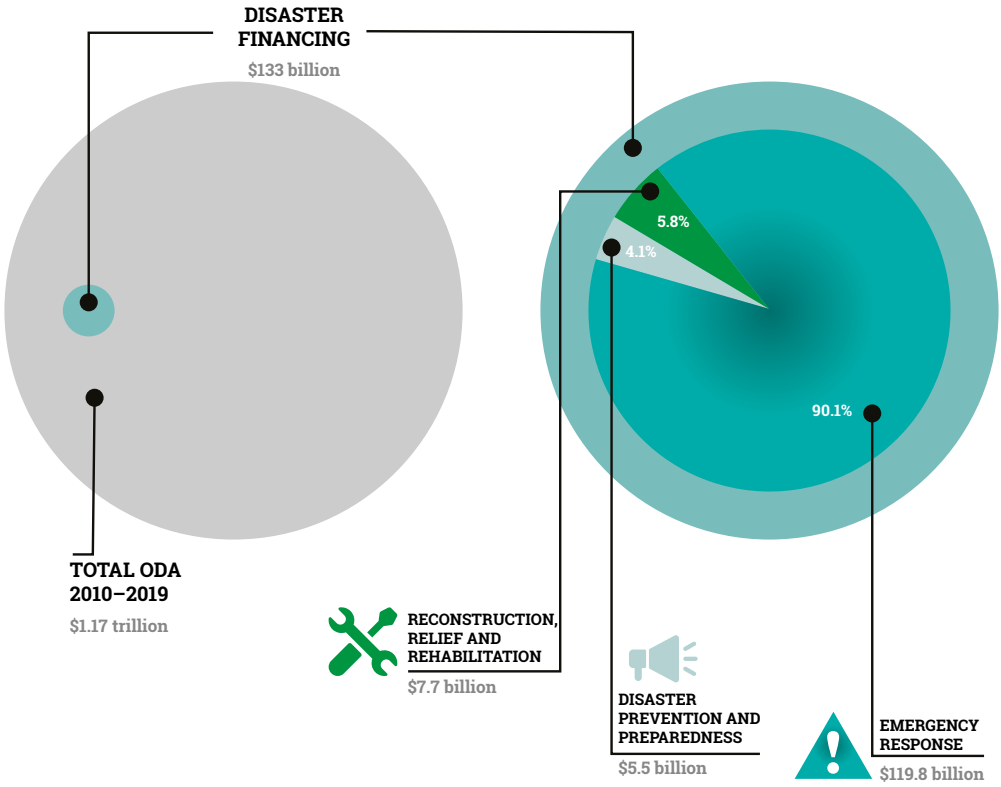
It is not inevitable that risk continues to grow. The best defence against systemic risk is to transform systems to make them more resilient. Global governance and financing systems have not caught up with this new imperative. For example, Figure S.8 shows how resilience-oriented finance accounts for a tiny percentage of official development assistance (ODA). Resilient investment is not even trackable as an investment on most public or private sector balance sheets.

Figure S.7. Top countries with highest levels of the INFORM Natural Hazard Risk Index and their shares of population under the national poverty line, 2021



Source: UNDRR analysis based on INFORM Natural Hazard Risk Index (European Commission, 2021) and Global Sustainable Development Goal Indicators Database (UN DESA, 2021)

Figure S.8. **Disaster-related financing as share of ODA**



Source: UNDRR analysis based on OECD.Stat (OECD, 2021)

A call to action to accelerate risk reduction

The ideas presented in GAR2022 are intended to inspire action and innovation at local, national and international levels to safeguard development and the planet's future. The report calls for action to: (a) measure what we value, (b) design systems to factor in how human minds make decisions on risk and (c) reconfigure governance and finance systems to work across silos and design in consultation with affected people.

Measure what we value

Addressing systemic risk requires applying metrics that reflect economic, and also planetary and societal health. When systems are not collecting the right data, key assets are undervalued in decision-making and learning opportunities are missed. Current measurement systems are myopic, too focused on the short term, and fail to consider cascading impacts and/or transboundary risk. These limitations hinder effective understanding, assessment and action to address systemic risk.

For example, in most countries, ministries of finance lack tools to account for the future risks of climate change to their pension fund investments. They cannot account for the ecosystem assets on which their economies depend. Public sector balance sheets do not yet factor in the cost of destruction of groundwater by mining over 40 years of production against the 200+ years it will take to recover, or the species loss as a result. The design of a dam in one jurisdiction traditionally considers only the risk to the communities and environments in that same jurisdiction. Such design decisions are currently made based on historical and limited trend data. This makes infrastructure rapidly "out of date" and vulnerable, particularly in the face of accelerating climate change impacts.

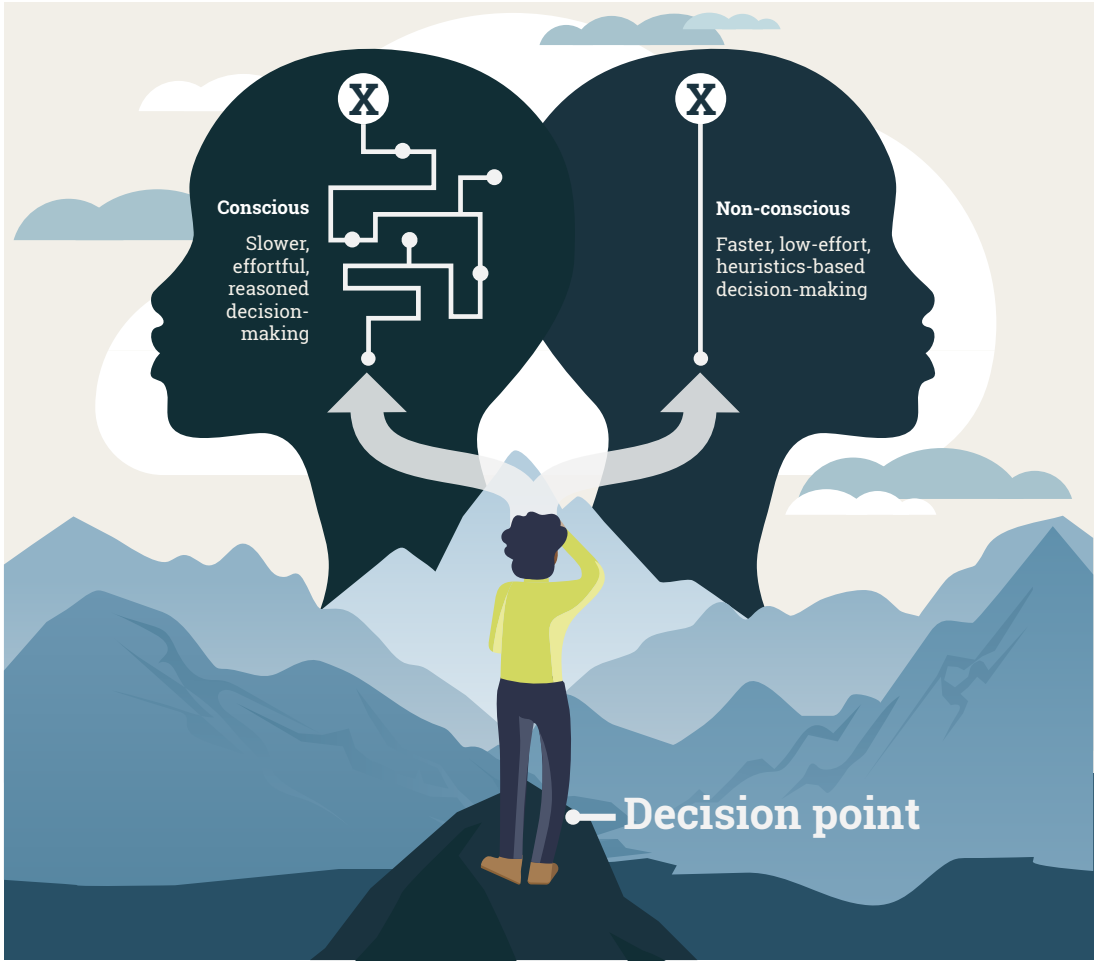
Better understanding systemic risk can also help in less-existential crises. For example, during the COVID-19 crisis, it became clear that countries do not have a way to measure the value of strong, flexible, well-managed companies that can pivot to produce essential items such as medicine and hand sanitizer during crises. This short-termism is a dangerous form of simplification that masks latent and potentially highly expensive systemic risk built into financial and planning systems.

But incremental action can have a powerful cumulative impact in increasing understanding of systemic risk. For example, the basic data-collection systems of most countries are not yet able to fully track the extent of disaster damage and loss, let alone track progress across all 17 SDGs. However, this information is the foundation for the kind of data infrastructure required for the next generation of models for assessing systemic risk during operational decision-making. For example, stress testing for systemic risk behaviour of the global food system is currently not possible because high-resolution data on crop management and basic production is not available.

Design systems to factor in how human minds make decisions about risk

As established approaches have been insufficient to address current levels of risk, innovation and adjustments are required. GAR2022 explores why a better understanding of how people make decisions about risk can accelerate effective action on risk reduction by suggesting how to do things differently. Cognitive research shows how decisions regarding disasters are often influenced by short-term thinking or other motivated reasoning (Figure S.9). Well-informed decisions can result from experience; however, by definition, this is impossible with novel risks such as climate change or intensive hazards like major tsunamis. This increases the likelihood that people and institutions will either not pay attention to the potential consequences of novel risks, or over-react to more familiar risks based on their recent experience of disaster.

Figure S.9. Heuristics and decision-making



Source: Infographic courtesy of © One Earth Future Foundation (2022)

These innate biases or mental short cuts lead to the human mind being myopic, and prone to inertia, oversimplification or herding when decision-making around risk. For example, a commonly used mental short cut is to simplify complexity by attempting to determine a linear cause and effect (Kahneman, 2013). However, because systemic risk is not linear, this tendency to oversimplification is not serving human societies well in coping with the complexity of global challenges. For example, in Iceland, regulatory myopia in the banking system allowed risk to accumulate, eventually leading to system collapse in 2007 (Figure S.10). Such approaches are leading to new risk creation, as "ignored" systems like ecosystem health or pandemic risk are not considered until too late.

While these biases are part of the human cognitive system, that does not mean such negative outcomes are inevitable. Designing approaches to take these biases into account is possible, and can flip current systems to increase resilience instead of risk.

Empirical studies have shown the way calculations on risk are explained can have a significant impact on efficacy. It has been found that decision makers are more likely to consider undertaking risk reduction measures if they are told that over the next 25 years, there is greater than a one in five chance of a destructive disaster rather than a 1 in 100 annual probability, even though the base calculations are the same (Chaudhry et al., 2020; Robinson et al., 2021).

Applying this thinking to tools like risk-based insurance, short-term economic incentives, and the design and enforcement of regulations or standards could play a key role in accelerating risk reduction action. For example, since the State of Florida in the United States of America upgraded its building code and risk communication strategies in 2001, homes built to the new standards have suffered on average 53% less damage during the storm season (GAR2022, Chapter 8).

Effective risk communication is also key. A poorly informed public can make decisions that exacerbate existing risks and create new ones, especially amid uncertainty. The speed of change within both traditional and new media and communication ecosystems has outpaced legislation, public-interest business models, and media and digital skill rates. This has left people more susceptible to false and misleading information and more likely to share it. This is important for people making critical decisions about risk that will affect their lives and livelihoods. Figure S.11 points to enablers of good risk communication (GAR2022, Chapter 9).

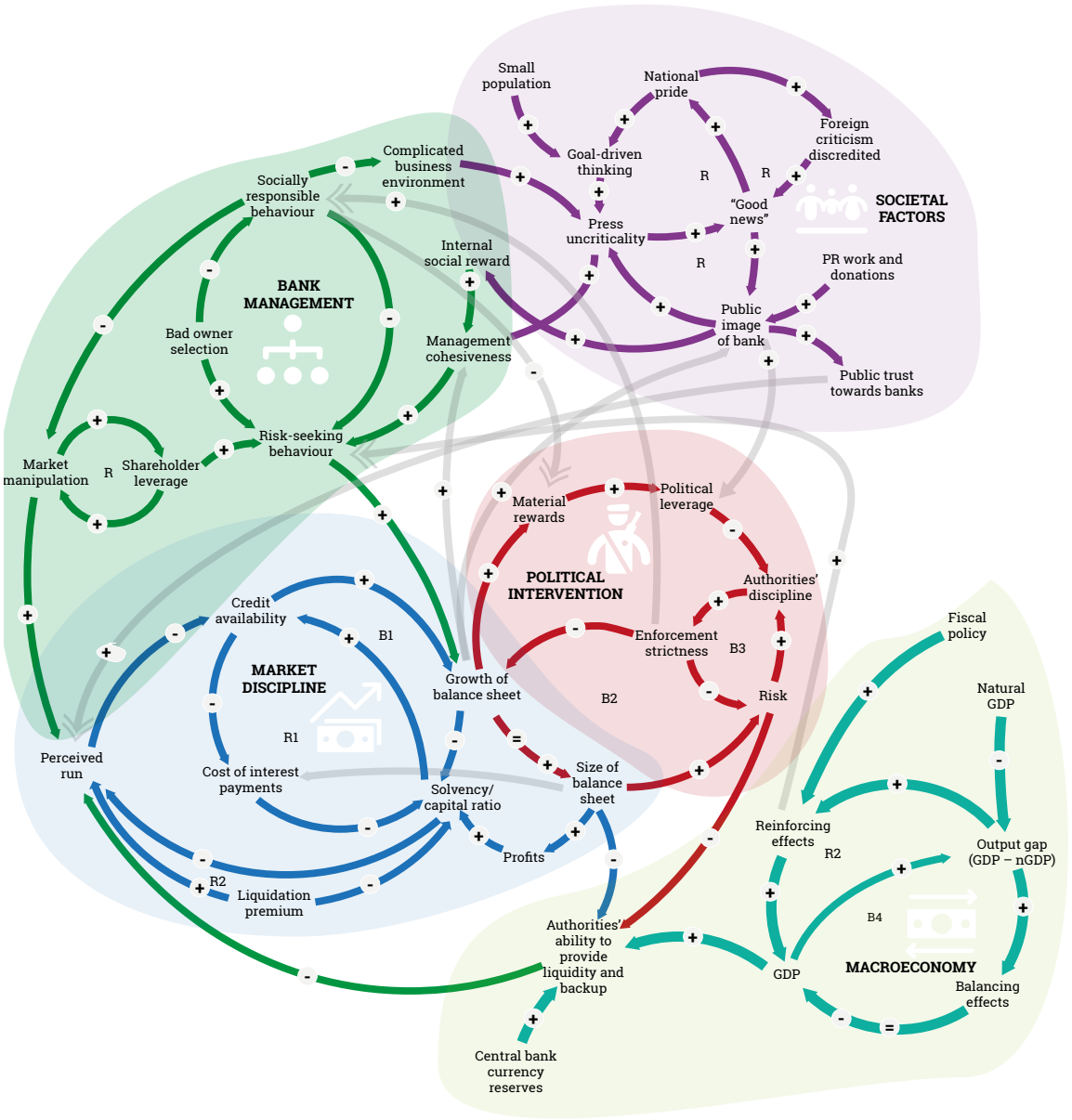
Societies have more data about risks than ever before, but it remains rare to have productive conversations about it with the right people, at the right times and at the right scale. Current public debates about vaccine mandates and safety in the wake of the COVID-19 pandemic, including potent conspiracy theories, are a testimony to this challenge.

Failing to communicate about risk effectively – indeed, failing to communicate at all – can fuel rumour, erode trust, hamper solutions and even increase risk. It can lead people to underestimate or ignore some risks and overestimate others, thereby misallocating resources and endangering lives.

Reconfigure governance and financial systems to work across silos and design in consultation with affected people

To help underpin better risk understanding, GAR2022 also looks at emerging methods to assess emerging systemic risks and impacts. These new methods do not enable prediction of the exact tipping points, such as on which day the

Figure S.10. Systemic risk in the Icelandic financial system, 2007



Note: GDP = gross domestic product; nGDP = nominal gross domestic product; PR = public relations.

Source: Arnarson et al. (2011)

stock markets will crash, when supply chains will cease to function or when the 1.5°C safe global climate change target is breached. Events like these may be triggered by events that cannot be predicted, like a political scandal, or rest on a multitude of variables. However, they do allow prediction, given a trigger event, of what the consequences will be throughout the system. For example, if Bank A declares bankruptcy on day 1, what does that mean for Bank B on day 7? Will it be able to repay liabilities to Bank C, or will it become illiquid, and declare bankruptcy as well? Models can tell observers what happens after the tipping point is reached. These tools have been widely applied in the financial sector, so the challenge now is whether they can be applied to disaster risk reduction. Initial signs are positive.

One approach to modelling complex systems and their risk exposure is as follows: (a) data sets are converted to network information for nodes and links and (b) this data is used in combination with knowledge of how shocks propagate in that specific system, which makes it possible to compute systemic risk. Once made visible, the systemic weak points become easily identifiable. For example, an effort was made to model a full electricity network hierarchy for England and Wales, which includes infrastructure assets, such as hospitals, that rely on that system. Based on this network analysis, weak points were identified, and the information applied to help prioritize investment in flood defence systems (GAR2022, Chapter 10).

Researchers are also looking at how cascading systemic risk affects wider sustainable development. For example, recent modelling efforts have highlighted how potential storm surges in Saint Lucia could cause cascading impacts across social and economic sectors. The results shown in Figure S.12 reveal how freight disruptions could lead to cascading effects on industries that employ more than 25% of the labour force, reducing the supply of vital goods, including wheat, medicine and food, and also fuel for cooking and electricity.

Canadian research is looking into using similar network analysis to help understand the mental health impacts of climate change and weather-related events, including post-traumatic stress disorder, depression, anxiety, loss of personal and occupational identity, substance abuse, and feelings of helplessness and fear (Gachon et al., 2022).

Such systemic risk modelling is only of use if it is used in decision-making, and if institutional systems evolve to be more comfortable with uncertainty. The planning systems and institutional culture of the twentieth century worked towards fixed time frames, for known outcomes in contexts that were largely stable and linear, or were assumed to be. The complexity of today's world and the destabilization of global ecosystems through climate change and other direct human impacts require that twenty-first century institutional cultures must become more agile and flexible. They need to manage responsively within wider parameters of possible outcomes rather than assuming only that there are static targets to be met.

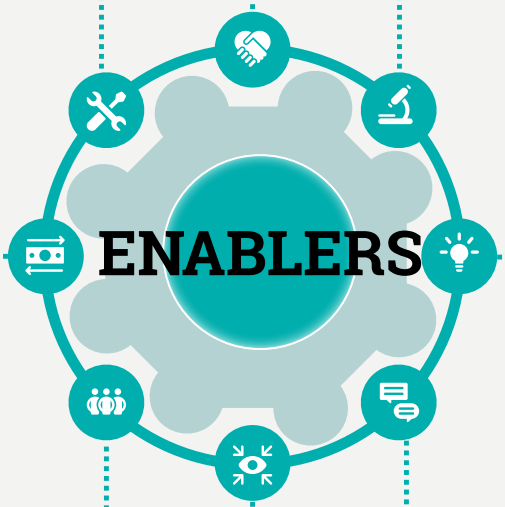
This does not mean discounting science, which provides essential insights into trends, relationships and solutions. It does mean recognizing that the sheer number of variables within systemic global risk makes it impossible to settle on a single trajectory. Planners need to consider "baskets" of possible outcomes, to be more agile in identifying when changes in assumptions are needed, and to respond to those changes actively.

Figure S.11. Enablers of good risk communication

EFFECTIVE COLLABORATION with the media and creative sectors is enabled if individuals and agencies approach with interesting stories, simple language, ready-to-go, skilled interviewees, and insight into how issues of DRR affect audiences' everyday lives. Understanding the media remits and time frames (varying from hours to even years, depending on the type of media output) they are working towards is essential.

PEOPLE ARE WILLING AND EFFECTIVE AT COLLABORATING ON RISK COMMUNICATION WHEN STRONG RELATIONSHIPS ARE IN PLACE. Nurturing these includes identifying each other's objectives and differences to build trust and develop the skills to communicate effectively.

"KNOWLEDGE BROKERS" can play an important role in "translating" across sectors and aligning conversations with positive outcomes. For example, the Science Media Centre (United Kingdom) and the work of UNDRR on strengthening the capacity of local journalists aim to broker better connections, and therefore information flows, among journalists, scientists, disaster risk experts and decision makers.



FINANCE FOR COLLABORATION on risk communication is increasingly important, at a time when financial constraints on independent media (whether online, broadcast or in print) are intensified by the economic downturn from COVID-19. These can curtail public interest content.

POLICYMAKERS, INCLUDING SCIENTIFIC ADVISERS, hold a delicate balance of trust among themselves, and with the public and scientific communities. Inevitably, there will be disagreements, but communicating multiple scenarios along with benefits and drawbacks for the public may foster productive conversations and solutions.

INNOVATIVE COLLABORATIONS are needed more than ever to support media content that is free from political interest, economically viable and serves the public good, inclusive of languages and interests across societies.

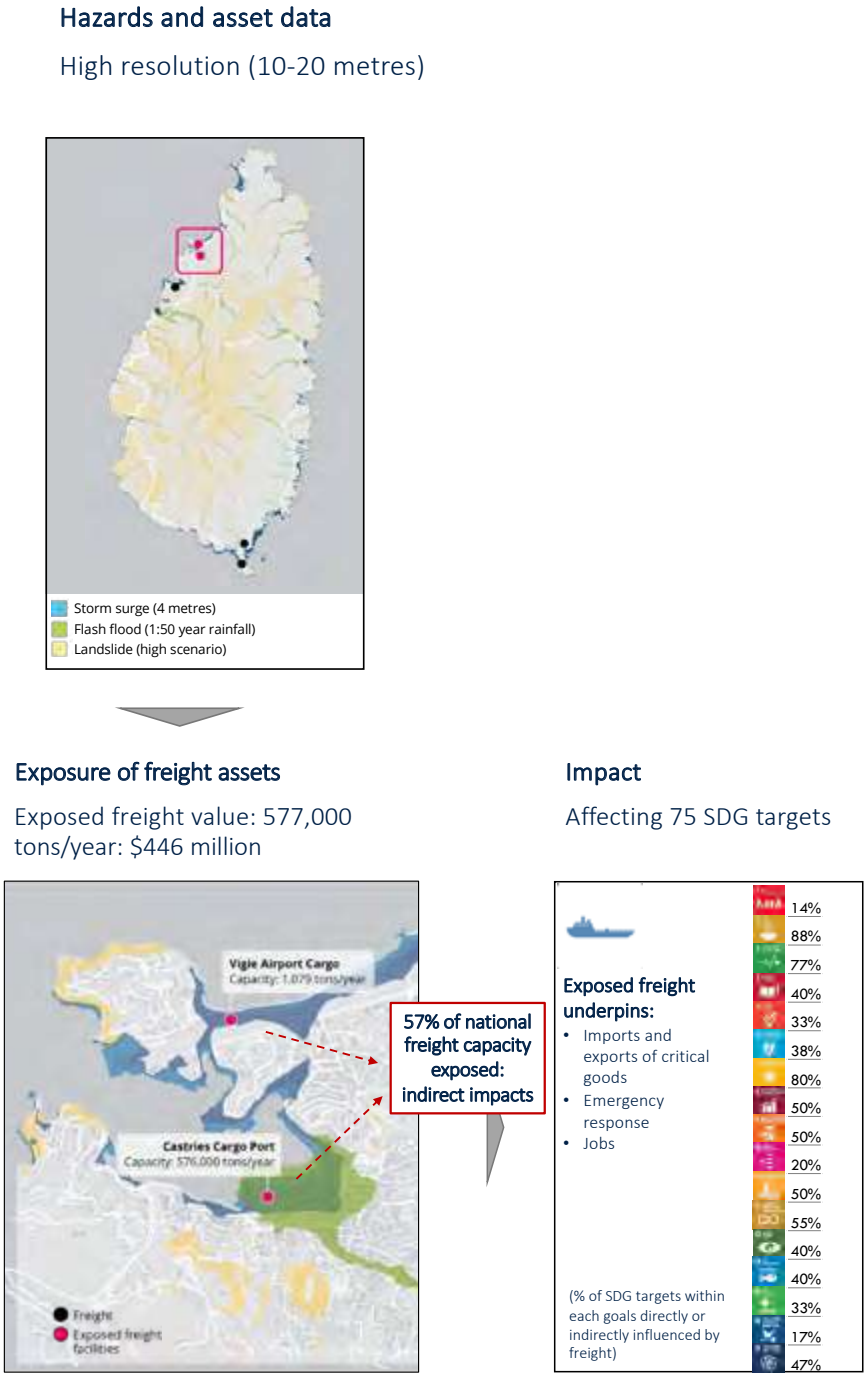
PUBLIC-FACING ACADEMIC EXPERTS can benefit from expanding their fields of knowledge by working in DRR, but also have a responsibility to know their limits and refrain from commenting on areas beyond their scope of expertise.

CLEAR COMMUNICATION on different scenarios and risk reduction options for business can foster relationships and collaboration within the private sector, government and civil society (e.g. the Asian Preparedness Partnership).

Note: DRR = disaster risk reduction.

Sources: McManus and Tennyson (2008); Gluckman (2014); Ink and Thurmaier (2018); ADPC (2019); Luminate (2020); Quigley et al. (2020); Gluckman et al. (2021)

Figure S.12. Analysis of port and freight exposure to climate-related hazards in Saint Lucia and interdependent impacts on SDG targets



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

Source: Pant et al. (2022) based on Adshead et al. (2020)

Key actions

As humans have altered their natural environment and changed it to a "a big world, small planet" (Rockström and Klum, 2015) or a "full world" (Daly, 2005), the logic of how to value, choose and make decisions, in other words, how to govern, has changed. In addition, the scale and impacts of human activities are now less frequently absorbed by nature and are becoming increasingly transparent. Feedback cycles are shorter and faster, and the consequences that human actions have for nature rebound onto human health and well-being.

It is both possible and imperative to accelerate action for risk-informed sustainable development. Good development does not need to create systemic risk. When investment reduces risk, systemic benefits also cascade across systems. For example, reducing urban black smog emissions decreases carbon dioxide, incentivizes cleaner energy and improves health outcomes.

In the face of global systemic risk, governance systems must quickly evolve and recognize that the challenges for the economy, environment and equality can no longer be separated. Conventional approaches to risk governance have tended to be based on linear or well-established cause-and-effect relationships. By contrast, systemic risk governance needs to recognize complex causal structures, dynamic evolutions and cascading or compound impacts. The recommendations of GAR2022 take the form of a call to action.

1. To help measure what we value

The world is not on track to reduce risk. The costs of disasters are increasing in both social and economic terms, threatening sustainable development (GAR2022, Chapters 2 and 3). Balance sheets ignore key variables, particularly undervaluing climate change risk, costs to ecosystems and the positive social benefits of risk reduction. The real costs of extensive risk are especially undervalued, and this gap is widening as major climate change impacts such as sea-level rise gather pace. To help measure what we value, key actions are to:

1.1 Rework financial systems to account for the real costs of risk, particularly long-term risks, and rework investment and insurance systems to incentivize risk reduction

Governments and the financial industry urgently need to improve how they account for the extent of financial assets at risk under various future climate change scenarios. Social and environmental impact assessments undertaken during the initiation of projects need to be extended to include regular reporting by the public sector, major companies, investments and pension funds. Risk myopia means there are few safe options offered for risk-resilient investments. Just as green bonds helped accelerate the finance of renewable energy, similar financial products are needed to incentivize and ease investment that is resilient to disaster risk and climate change. For example, since 1997, Costa Rica has led in the use of financial levers

to promote conservation and climate change action, using carbon tax revenues to fund forest preservation and sustainable development (GAR2022, Chapter 8). More recently, in 2020, De Nederlandsche Bank became the first central bank to track biodiversity as a material financial risk. This action revealed that 36% of the portfolio values of the Dutch financial institutions were exposed to nature-related risk (GAR2022, Chapter 5).

1.2 Adapt national fiscal planning and risk financing to consider risk and uncertainty

Public sector finance "stress-testing" methodologies need to be extended to learn from the COVID-19 pandemic, and to test for a wider range of systemic risks with potentially cascading impacts. National budgets also need to evolve to include risk and uncertainty components, so financial planners can become more adept at adaptive planning and are better able to pivot resources in crisis situations. New impact modelling techniques show how, in places such as Saint Lucia, a storm surge can have cascading impacts across the economy that threaten sustainable development (GAR2022, Chapter 10). National and regional approaches to disaster and climate risk financing that layer risk through different forms of insurance and contingency funds also provide ways to deal with various levels of risk and uncertainty (GAR2022 Chapters 2, 8 and 11).

2. To help design systems to factor in how human minds make decisions about risk

Policymakers and providers of disaster risk reduction products and services to households and communities continue to undervalue how risk perceptions, including cognitive biases, influence decision-making. To help design systems that factor in how human minds make decisions about risk, key actions are to:

2.1 Recognize the role of people's perceptions of risk and biases to close the gap between intention and action in reducing risk

Adjusting how insurance products are marketed can have a transformative impact on ensuring risk-resilient investment. This includes reframing risk approaches such as using "opt-out" rather than "opt-in" schemes for flood insurance (GAR2022, Chapters 8 and 11). Improving codes and standards, and also the communication around why they are necessary, is key. For example, after the 2010 earthquake and tsunami, the Government of Chile helped incentivize safe construction by providing funds to poor families to cover the cost of "half a good house" that adhered to building code, but which also allowed personalization of homes by owners (GAR2022, Chapter 4).

2.2 Recognize the value of risk analytics as a tool but not a panacea

Lessons learned from the COVID-19 pandemic show that the success rates of models were uneven in predicting the spread of the disease within and among countries. Decision makers went from an over-reliance on models to extreme scepticism about their utility. Modelling tools can help people think about things in a better way, but they cannot predict the future with granular accuracy. No models are 100% reliable. However, they are essential tools as long as the people who interpret them do not have unrealistic expectations of their omnipotence or dismiss them. Governments can, and should, invest in data analytics, but only if quality models and big data use are combined with methods to draw on local knowledge, community feedback and expert opinion. For example, in West Africa, resilience strategies for the cocoa industry are being developed using climate change models combined with storylines, co-created with producers, importers and representatives from civil society and government (GAR2022, Chapter 11). In Finland and Norway, land-use foresight processes are used to help investigate impacts of decision-making on society, the economy and the environment. Methods combine digital stakeholder engagement platforms, spatial data and a range of outreach tools to engage the public in planning processes (GAR2022, Chapter 4).

3. To help reconfigure governance and financial systems to work across silos and design in consultation with affected people

Governance and financial systems are not yet embracing transdisciplinary approaches and tend to take top-down approaches. To help reconfigure governance and financial systems to work across silos and design in consultation with affected people, key actions are to:

3.1 Embrace a new "risk language" that cuts across multiple disciplines

Disaster risk management actors and other sectors speak differently about risk and too often operate in sectoral silos. There is a need to look more at systems, not individual hazards, and to work across disciplines. This requires increased efforts to create common terminologies and provide open access data across disciplines to create shared knowledge, encourage lateral collaboration and speed up the pace of learning. Disaster risk modellers have been learning from tools developed to measure cascading effects during the last financial crisis and from enterprise risk management approaches. But this learning needs to go both ways between governments and communities, and be built into planning and budgeting processes (GAR2022, Chapter 11). In Samburu County, Kenya, pastoralists, farmers and fishers needed access to forecasts of extreme weather to make critical decisions that affect crops, animals, and their own safety and quality of life. A communication gap that developed between these end users, climate scientists and local media was bridged by a trust-building collaboration that developed ways to translate scientific data into useful information for local communities

(GAR2022, Chapter 11). At the global level, initiatives such as the UNDRR and International Science Council joint Hazard Definition and Classification Review, the new Centre of Excellence for Climate and Disaster Resilience established by UNDRR and the World Meteorological Organization (GAR2022, Chapter 1) and similar inter-agency collaborations that upgrade disaster damage and loss reporting are helping to increase the interoperability and utility of data systems. Such efforts need to be supported to enable enhanced risk understanding at a global level.

3.2 Step up participation, transparency and citizen dialogue in risk decision-making to accelerate learning and necessary adjustments

Modern technology provides opportunities to accelerate learning and to quickly pick up signals essential for effective risk management in an uncertain future. But acting on these signals requires nuanced forms of communication with the public, and particularly better communication with higher-risk groups. Enhanced social protection systems targeted towards at-risk groups can be a good vehicle for better understanding who is most vulnerable to emerging risks and for ensuring effective anticipatory action to prevent acute humanitarian crises. For example, post-disaster analysis in Guatemala showed how awareness and community dialogue and action were central to effective action after a volcanic eruption (GAR2022, Chapter 4). In New Zealand, citizen dialogue has been able to harness vital local indigenous knowledge essential to improve ecosystem management (GAR2022, Chapter 6). In Wolong, China, participatory governance and cross-government systems for forest conservation were key to local support for a transition to nature-based solutions, adaptation and systemic risk management (GAR2022, Chapter 12).

3.3 Enhance multi-scale risk management

Rifts can emerge between the national and local levels during major crises, as was the case in many jurisdictions during the COVID-19 crisis. Autonomy for local-level action is essential. More emphasis is required in scenario planning to manage extensive disasters and to handle governance issues resulting from cascading impacts. For example, adjustments made to health systems based on local knowledge and feedback were essential to building trust during the 2014 Ebola outbreak in Liberia (GAR2022, Chapter 7). In Canada, an InterSectoral Flood Network of Quebec presents modelling data and also explicitly facilitates co-training among members to promote a vision that is systemic and intersectoral, engaging universities and various socioeconomic partners and disciplines (GAR2022, Chapter 10).

GAR2022 outlines how immediate action around these three areas can help governments, local communities and individuals better position themselves to cope with a volatile, uncertain future. The keys to building resilience and accelerating sustainable development are measuring what we value, designing systems around the way people make decisions on risk, and reconfiguring governance and financial systems to work collaboratively and across silos. As climate change impacts gather pace, we know what is at stake for future generations. The baseline is established. The time for action is now.

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