B20 ITALY

Action Council on Sustainability and Global Emergencies

Policy Paper 2021

B20 ITALY 2021

RESHAPE THE FUTURE: INCLUDE, SHARE, ACT

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Foreword by the Taskforce Chair

2020 definitely marked a discontinuity in everybody's life. The outbreak of the Covid-19 pandemic highlighted the exposure of our society to global risks, and it showed how interconnected our systems are. A local crisis can rapidly turn into a global emergency, capable of affecting our lives, economies, and the environment around the world.

In this framework, the newly established Action Council in the B20 Italy has worked on a concrete plan to address government responses to global risks, focusing on two arising priorities: "Sustainability" and "Global Emergencies". Referring to sustainability, we have been guided by the Sustainable Development Goals (SDGs) set by the United Nations in the 2030 Agenda, which provide a global perspective to fill the existing, social, economic and environmental gaps within and among countries.

Concerning global emergencies, through a risk-based methodology we have selected three major challenges: Environmental Disasters, Infectious Diseases and Cyber Incidents. In light of their effects, their probability of occurrence and their potential impact on the achievement of the SDGs, these threats require actions at global level.

Furthermore, to be effective in our goal, we have analyzed global emergencies along the entire management "life-cycle": from the preparedness phase, to enhance the resilience of a system against the emergency; during the crisis, to help manage an emergency with an effective and timely response; and afterwards, to support a sustainable recovery. This approach is also reflected in the structure of the policy paper.

The Action Council's policy recommendations to the G20 hence deal with: i) committing to a sustainable and just transition as well as establishing a comprehensive mechanism to prevent, manage and promote sustainable recovery from environmental disasters; ii) improving resilience and management against the spread of infectious diseases; iii) strengthening infrastructure and data security against major cyber incidents.

In order to be pragmatic, we enriched the policy actions with business cases and best practices related to public-private partnerships, namely examples to show the immediate applicability of our proposals.

Nonetheless, while addressing the prioritized emergencies, we have acknowledged some general principles that are crucial to manage global risks of all kinds and should underpin the world's responses through "including", "sharing" and "acting". These fundamentals cover: empowering people, who are key in the prevention and response to risks, by providing public awareness as well as education programs; sharing information to improve decision-making processes; harnessing advanced technologies and digitalization, which are enablers to build resilience and improve emergency management, committing investments in prevention.

As Chair of the Action Council, I want to thank our Co-chairs and all members, Confindustria and our Knowledge Partner McKinsey, who have contributed to the drafting of the Policy Paper through a fruitful and continuous discussion, providing wide and cross-sectoral perspectives.

Leveraging our business experience, we wish to convey to the G20 concrete and impactful recommendations to support governments around the world in finding sustainable solutions and in delivering proper tools for the protection of people, economies and the environment against global emergencies.

Sincerely,
Claudio Descalzi
Chair of the 2021 B20 Action Council on Sustainability and Global Emergencies

Quotes by the Co-Chairs

Dina Hasan Al Nahdy
ENTEC Environmental Technology, CEO

"The growing deterioration of the environment and climate change take a huge toll on the economy and natural resources, therefore should be the highest priorities for legislators and global society. In a time of an unprecedented climate and environmental crisis, it is our duty as B20 Members to find global circular economy solutions to ensure a sustainable future for generations to come."

Jean-Pierre Clamadieu
ENGIE, Chairman

"The COVID-19 crisis is a wake-up call for States and corporations. Environmental disasters prevention and climate change call for unprecedented public policy initiatives. Long-term objectives for carbon-neutral growth, combined with targeted public investments and appropriate market incentives, will contribute to a sustainable, fair and inclusive future."

Wendy Mars
Cisco, President EMEAR

"As business leaders, we hope to give useful insights to the G20 on how to deal with the global emergencies that threaten us all. Recent cyber incidents have proved that quick, decisive and coordinated action is vital to protect our critical infrastructure and to strengthen cybersecurity for everyone."

Paulo Nigro
GranBio, Former CEO; InConnection, Founder & Senior Advisor

"We only have one planet and yet we seem not to have learned from past generations. We produce today more greenhouse gases than ever before, with areas such as the Brazilian Amazon Forest at risk of "savannization". We need to stop, act, mitigate and adapt to reduce the current human footprint. We cannot wait any longer."

Dilip S. Shanghvi
Sun Pharmaceuticals, Managing Director

"Sustainable action policies are key to effectively prevent, mitigate and manage the 3 priority global emergencies (environmental disasters, infectious diseases and cyber incidents). Clear action plans have been outlined for emergency preparedness and resilience building, timely response, equitable access to resources and sustainable recovery – for the G20 and others to act upon".

Jian Wang
BGI Group, CEO

"Environmental disasters, infectious diseases, and cyber incidents are truly emergencies we have to confront globally in a sustainable way. For infectious diseases, strengthening cooperation in their surveillance and control as well as building-up a more responsive health system at the B20 level are key for prevention and responsiveness."

Bill Winters
Standard Chartered, CEO

"The G20 has a critical leadership role to play in unlocking the large sums of capital required to avert the ongoing climate emergency. I look forward to working together to secure a sustainable low-carbon future for our planet."

Recommendations: Executive Summary

Recommendation 1: Commit to and set clear pathways to a sustainable and just transition and establish a global mechanism to prevent, manage and foster sustainable recovery from environmental disasters – The G20 should confirm its commitment to and encourage further action for environmental risks reduction and climate change mitigation as driving forces to deliver on net-zero emissions targets and achieve sustainable development in line with the UN's Sustainable Development Goals (SDGs).

• **Policy action 1.1: Commit to and set clear pathways to a sustainable and just transition** – To accelerate the transition to a carbon-neutral, environmentally sustainable and inclusive economy and deliver on Paris Agreement goals, G20 members should encourage the financing and development of climate mitigation measures such as carbon-reducing technology and carbon markets, and incentivize sustainable research and development, investments, consumption and production choices. At the same time, G20 members should develop initiatives to support the transition towards carbon-neutral solutions of countries, regions, industries, communities and workers that are experiencing barriers in the adoption of sustainable and carbon-neutral economy models.

• **Policy action 1.2: Promote the consistency of environmental sustainability reporting standards and reinforce global governance to enhance technological innovation** – G20 members should promote harmonization and improve the transparency of existing non-financial disclosure standards to help allocate sustainable financing more efficiently, and reinforce global governance to speed innovation for environmental disaster management.

• **Policy action 1.3: Enhance emergency recovery and financing schemes** – G20 members should cooperate to create worldwide recovery and financing schemes that facilitate fast and targeted relief where it is needed the most with green, sustainable and equitable approaches, turning climate and environmental challenges into opportunities.

Recommendation 2: Enhance resilience and management against future infectious disease outbreaks – The G20 should build on COVID-19 experience to develop consistent and coordinated plans to enhance resilience and management in future pandemics, reinforcing healthcare and surveillance systems, supporting global value chains during crises, and favoring global equitable access to diagnostics, therapeutics and vaccines.

• **Policy action 2.1: Build future pandemic preparedness** – G20 members should strengthen pandemic preparedness by increasing coordinated R&D efforts, reinforcing global frameworks, adopting a "One Health" approach and promoting education campaigns.

• **Policy action 2.2: Promote global cooperation and value chain resilience during outbreaks** – G20 members should reinforce global cooperation, transparency and information-sharing to manage emergencies and foster the adoption of disease surveillance systems and advanced technology, e-Health solutions, business continuity plans, and the resilience of global value chains.

• **Policy action 2.3: Scale up diagnostics, therapeutics and vaccine development and rollout, and adopt economic measures to speed a sustainable and inclusive recovery** – G20 members should support the rapid scaling of diagnostic, therapeutic and vaccine production and equitable availability after infectious disease outbreaks, adopting clear guidelines and economic measures.

Recommendation 3: Reinforce critical information infrastructure and data security against major cyber incidents – The G20 should strengthen its efforts to develop more resilient and sustainable critical information infrastructure and data security, and clear approaches to crisis management and recovery, to protect digital access and cross-border data flows, especially during and after major cyber incidents.

• **Policy action 3.1: Improve global coordination to strengthen cybersecurity** – G20 members should promote global coordination to improve the security and resilience of critical information infrastructure and data, developing a shared risk-based framework rooted on existing global standards, promoting the adoption of security and privacy-by-design principles, and enhancing cyber defense resources and capacity for both single organizations and supply chain networks.

• **Policy action 3.2: Facilitate data- and intelligence-sharing during major cyber incidents** – G20 members should promote a shared cyber incident response plan, encourage global information-sharing practices, and address the interoperability of cross-border data flows during major cyber incidents while protecting data privacy and security.

• **Policy action 3.3: Implement post-breakdown recovery plans** – G20 members should build public-private relationships to design and implement a robust and resilient joint post-emergency recovery plan for major cyber incidents, and ensure stable and secure network operations and data management at all times.

Introduction

The COVID-19 pandemic has served as an unprecedent wake-up call for leaders, highlighting the deep interconnectedness and interdependence of global systems.

The COVID-19 pandemic has tragically caused nearly 4.8 million deaths at the time of this writing[1], and it will continue to have significant impacts on human health and the global economy. Research suggests that global GDP fell by 4.2% in 2020[2], and that 255 million full-time jobs were lost[3]. As the OECD put it in 2020, "the deep interconnectedness and interdependence of global systems imply that any local crisis can rapidly scale up to contribute to planetary environmental, social, economic, and political emergencies."

The pandemic's extraordinary impact has highlighted the fragility of our systems and the urgent need for coordinated and cooperative action at the global level, "laying bare deep inequalities," as the United Nations put it, "and exposing precisely the failures that are addressed in the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change."

Humans have already crossed a number of "tipping points" in the Earth's systems. It is time for all leaders in government, international institutions, business and academia to devise an "emergency response plan to protect their economies, jobs, cities and other crucial assets from potential disaster," in the words of the World Economic Forum, with coordination at the global level.

In this historical context, the B20 included in its 2021 agenda a new Action Council on Sustainability & Global Emergencies, whose activities and efforts are focused on the growing impact of global emergencies and the critical importance of sustainability in addressing them.

How to define a global emergency

The United Nations defines a global emergency or disaster as "a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources[4]." While emergencies can be fundamentally different, they usually share most of the following characteristics:

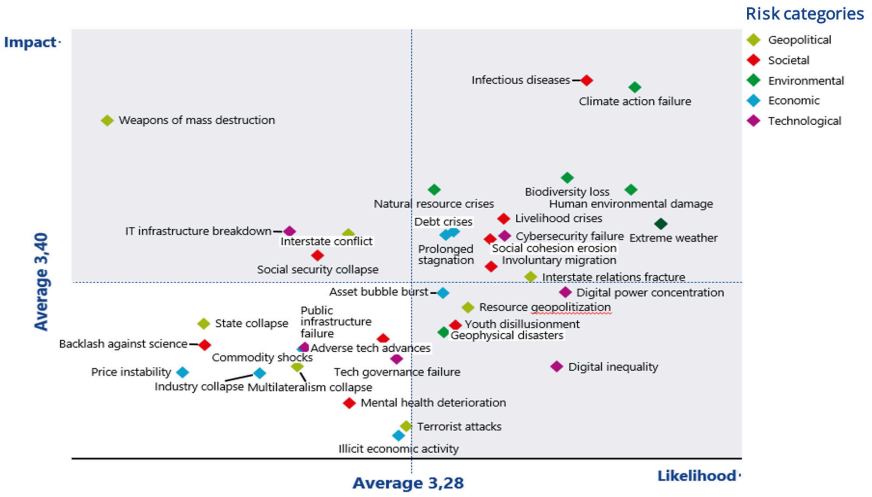
i. They are unusual or unexpected, without early signals, or with impacts that are different from past events;
ii. Imply severe system losses and damages—human, social, economic, environmental or material;
iii. Have a global or international dimension as they spread rapidly across geographies or require international intervention;
iv. Require the immediate action of multiple stakeholders such as governments, private sector agents or NGOs;
v. Have significant impacts on countries, economies and industries that last at least ten years.

Major global emergencies can be ranked by likelihood and impact, and by the hurdles they may present in achieving the 17 Sustainable Development Goals. In its 2021 Global Risks Report, the World Economic Forum identified 35 global risks and assessed each one on two dimensions (Fig.1): its expected like-

[1] *"Coronavirus dashboard", World Health Organization*
[2] *"Turning hope into reality", OECD Economic Outlook, December 2020*
[3] *"Covid-19 and the world of work", 7th edition, International Labour Organization Monitor*
[4] *"2009 Terminology on Disaster Risk Reduction", UN International Strategy for Disaster Reduction, 2009*

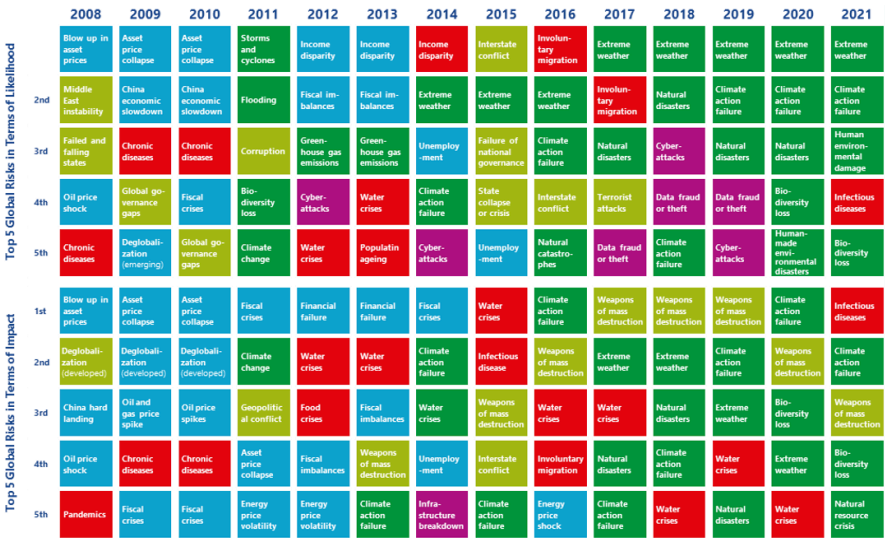
lihood and impact in the next ten years, all ranked on a scale of 1 to 5, with 1 representing an unlikely risk with a relatively low impact, and 5 a very likely risk with a major impact.

Figure 1: Global Risk Landscape, World Economic Forum (2021)



The 23 global risks with either or both above-average likelihood and impact—those in the three shaded quadrants—span the WEF risk categories: geopolitical, societal, environmental, economic and technological. As perceptions of risk have evolved over the past five years, technological, environmental and societal risks have become more prominent (Fig. 2).

Figure 2: Evolving Risks Landscape, World Economic Forum (2021)



All of these risks could occur and have significant impact, but they could also create hurdles in efforts to achieve the UN's 17 Sustainable Development Goals (SDGs) (Fig.3). As suggested by the Action Council's name, "sustainability" is the overarching principle of its scope of action and the lens through which it considers global emergencies.

Figure 3: Most impactful risks and their correspondence to the UN SDGs

The Action Council has chosen to focus on three main global emergencies: environmental disasters, infectious diseases, and cyber incidents.

To select which global emergencies should be the focus of its recommendations, the Action Council has taken into account trends in global risk perception, the SDGs affected, and the business community experience that governments can leverage in preventing, managing and recovering from crises. In light of these considerations, the Council has identified three priority emergency areas (environment, health and cyberspace), for which the following cases in point have been selected:

1. **Environmental disasters**: Natural disasters are increasingly intense, frequent and costly, with losses estimated at $165 billion in 2018[5]. The world will experience permanent losses even if we can limit the global average temperature increase to 2°C. Projections suggest that 99% of coral reefs will be lost, for example[6].
2. **Infectious diseases**: Healthcare systems have proven inadequate in responding to global pandemics. In June 2020, for example, 94% of countries reported that ministry of health staff previously tasked with working on non-communicable diseases were partially or fully reassigned to address COVID-19, stretching their resources thin[7].
3. **Cyber incidents**: Without common international digital standards and governance, IT systems and data protection mechanisms will continue to fail; in 2021 alone, cybercrime damages could top $6 trillion[8].

For overall sustainability efforts to be efficient and effective, leaders need to act in all the lifecycle phases of emergencies:

1. **Before they happen**, by enhancing preparedness and resiliency, improving the accuracy of their predictions and reducing risks;
2. **As they unfold**, by mounting effective and timely responses in coordinated and cooperative ways at an international level;
3. **In the aftermath of the emergencies**, by developing mechanisms for a sustainable recovery and transitions to a new normal.

We urge stakeholders to view actions in the three phases not as a linear process but as a self-reinforcing virtuous cycle that can help the world prevent and manage future crises more effectively.

[5] *"Natural catastrophes and man-made disasters in 2018: 'secondary' perils on the frontline", SwissRe Institute, 2019*
[6] *"Global Warming of 1.5 °C", Special Report, IPCC*
[7] *"COVID-19 significantly impacts health services for noncommunicable diseases", World Health Organization, June 1, 2020*
[8] *"Cybercrime to Cost the World $10.5 Trillion Annually by 2025", Cybersecurity Ventures, 2019*

Proposed recommendations

In the light of these considerations, the Action Council has organized its recommendations as follows:

• One recommendation for each of the three global emergencies selected: natural disasters, infectious diseases and cyber incidents;
• For each recommendation, one policy action for each of the three dimensions of resiliency: preparedness & prevention, emergency management, and sustainable recovery;
• For each policy action, two to nine more detailed topics for further consideration and in-depth analysis.

Recommendation 1: Commit to and set clear pathways to a sustainable and just transition and establish a global mechanism to prevent, manage and foster sustainable recovery from environmental disasters

The G20 should confirm its commitment to and encourage further action for environmental risks reduction and climate change mitigation as driving forces to deliver on net-zero emissions targets and achieve sustainable development in line with the UN's Sustainable Development Goals (SDGs).

Policy Actions

1.1 Commit to and set clear pathways to a sustainable and just transition
To accelerate the transition to a carbon-neutral, environmentally sustainable and inclusive economy and deliver on Paris Agreement goals, G20 members should encourage the financing and development of climate mitigation measures such as carbon-reducing technology and carbon markets, and incentivize sustainable research and development, investments, consumption and production choices. At the same time, G20 members should develop initiatives to support the transition towards carbon-neutral solutions of countries, regions, industries, communities and workers that are experiencing barriers in the adoption of sustainable and carbon-neutral economy models.

1.2 Promote the consistency of environmental sustainability reporting standards and reinforce global governance to enhance technological innovation
G20 members should promote harmonization and improve the transparency of existing non-financial disclosure standards to help allocate sustainable financing more efficiently, and reinforce global governance to speed innovation for environmental disaster management.

1.3 Enhance emergency recovery and financing schemes
G20 members should cooperate to create worldwide recovery and financing schemes that facilitate fast and targeted relief where it is needed the most with green, sustainable and equitable approaches, turning climate and environmental challenges into opportunities.

Leading Monitoring KPI	Baseline	Target
Environmental Performance Index, Median[9] (0-100 scale)	44 (2020)	55-60 (2030[10])

Source: *Yale Center for Environmental Law and Policy (YCELP), Yale University; Center for International Earth Science Information Network (CIESIN), Columbia University*
Owner: *G20*

[9] *Based on a methodology that can be subject to revision over time; see the Annex for more details*
[10] *Depending on Index availability for 2030; environmental performance improvement in 2030 could also be appreciated by considering the 10-year change, computed backcasting scores, if released*

Recommendation 1 contributes to eleven SDGs with primary effects on **SDG 7, SDG 11, SDG 12, SDG 13, SDG 15 and SDG 17**. The recommendation is designed to significantly reduce carbon emissions, support the implementation of a circular economy and include climate adaptation measures in business planning and development. These efforts will create positive spillovers to **SDG 2, SDG 6, SDG 8, SDG 9** and **SDG 10.**

Priorities include targets 2.3 and 2.4, with focus on increasing the productivity of small-scale food producers and the adoption of sustainable food production systems and resilient agricultural practices

The main focus areas are targets 6.3, 6.4 and 6.5, thanks to climate change adaptation's effects on water management, including efficient water use and pollution reduction.

Priorities include targets 7.2, 7.4 and 7.5, given the recommendation's effects on the penetration of renewables and best-practice-sharing among countries.

The main focus is on targets 8.2 and 8.4, thanks to efficiency improvements resource in consumption, production and diversification, and innovations and upgrades in economic productivity.

The focus is on target 9.4, thanks to the implementation of resource-efficient solutions, clean and environmentally sound technologies and industrial processes.

The main focus is on target 10.6, thanks to the fair representation and a voice for developing countries in global decision-making.

Priorities include targets 11.5, 11.6, and 11.b as investments are mobilized for sustaining populations in disasters, and for launching initiatives to reduce urban environmental impacts.

The primary concerns are on targets 12.1, 12.2, 12.5, thanks to the focus on resource efficiency, recycling, and a shared framework to enhance responsible consumption and a circular economy.

Great efforts are concentrated on sustaining climate actions, specifically on targets 13.1, 13.2 and 13.3, for strengthening environmental disaster resilience.

The main focus areas are targets 15.3, 15.4, 15.5, to preserve biodiversity and strengthen environmental and pandemic emergencies resilience with responsible resource consumption and circular economy practices.

Targets 17.9 and 17.16 are critically important, with the objective to strengthen multi-stakeholder partnerships, and share knowledge, expertise, technology, and financial resources to build capacity.

3Ps Impacted

Recommendation 1 is in line with all three principles of the G20 Italian Presidency: **People, Planet and Prosperity**

Context

Climate change and the accelerating destruction of nature are priority threats to humanity that require action from policymakers and global society.

Climate change is making natural disasters more frequent: the number of droughts, floods, extreme weather events and other environmental accidents, such as earthquakes, landslides, volcanic activity, wildfires, has risen by approximately 50% in the last 18 years, imposing damages of about $2.2 trillion[11], more than double the costs of the previous 18 years (Fig. 4). Severe wildfires in Australia in 2020, for example, burned more than one-fifth of the continent's entire temperate broadleaf vegetation[12]. In this context, emerging markets are particularly vulnerable. For example, around 1.36 billion people across South and East Asia are exposed to flood risk[13]. Between 2008 and 2018, research suggests that almost 55 million people across the region were displaced by weather-related natural disasters[14].

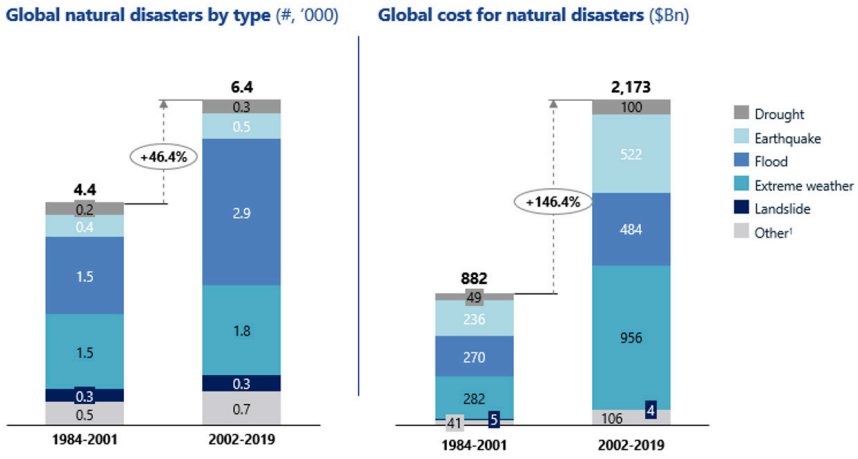


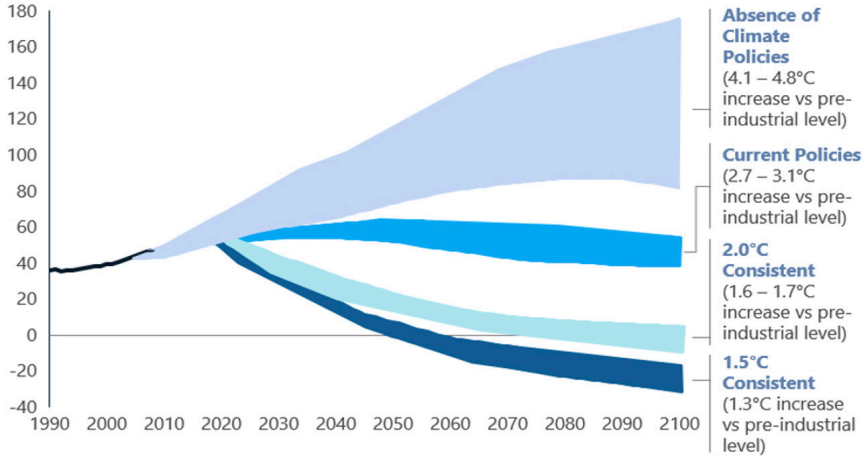
Figure 4: Natural disasters have increased in number and in related damage costs over the last 18 years, Oxford University and McKinsey Analysis

Carbon dioxide emissions, responsible for 64% of human-made global warming, have reached, with greenhouse gas emissions, more than 50 gigatons per year, and are increasing continuously with no sign of peaking. Policies in place today will not keep the world well below the 2.0°C temperature increase limit defined in the Paris Agreement (Fig. 5). Scientific evidence shows that limiting global warming to 1.5°C should help limit the intensity and frequency of climate and weather extremes, including severe droughts and the many risks associated with water availability, such as water stress[18]. The World Economic Forum (WEF) estimates that staying below the 1.5°C limit through 2030 would require a reduction of 50% of net emissions—about 23 gigatons per year—compared to 2019 levels[19].

[11] *Oxford University, McKinsey Analysis*
[12] *" Bushfires burned a fifth of Australia's forest: study", Phys.org, 2020*
[13] *"People in Harm's Way Flood Exposure and Poverty in 189 Countries", World Bank Group, 2020*
[14] *"Southeast Asia's Coming Climate Crisis" Center for Strategic and International Studies, May 22, 2020*
[15] *"Global warming and Climate Change", ECHA*
[16] *"Trends in Global CO2 and Total Greenhouse Gas Emissions; 2020 report", PBL Netherlands Environmental Assessment Agency, 2020*
[17] *IPCC Chair Hoesung Lee's opening statement at COP 25, Dec. 2, 2019*
[18] *"Impacts of 1.5°C global warming on natural and human systems", Intergovernmental Panel on Climate Change*
[19] *"Nature and Net Zero," World Economic Forum, May 27, 2021*

Decarbonization is critically important in limiting climate change, and the private sector must play a major role, applying pressure where governments have yet to take action. Decarbonizing supply chains could be a "game-changer," for example, in reducing CO2 emissions throughout the economy and helping the world reach the net zero transition more quickly, according to the WEF. Digital technologies can play a pivotal role in accelerating the green transition: in particular, an extensive uptake of smart digital solutions across sectors could already enable a 15% cut in global carbon emissions[20].

Figure 5: Global historical and projected greenhouse gas emissions in billions of tonnes of CO2 per year (Climate Action Tracker, 2020)[21]



The speed and scale of urbanization pose challenges in the fight against climate change. About 4.2 billion people, more than half the global population, live in cities today, a share that is likely to rise to 70% by 2050[22]. Urban land consumption has outpaced rising populations by about 50%[23], and urban energy consumption now generate about 70% of greenhouse gas emissions [24].

Ecosystem destruction and sharp declines in biodiversity have become serious threats "at least as much as human-induced climate change," according to Robert Watson, former chair of the UN's Intergovernmental Panel on Climate Change[25]. Some 40% of invertebrate pollinators face extinction, and land surface productivity has shrunk by 23% due to land degradation[26].

The Action Council approach

In our first recommendation, we strongly encourage the G20 advocacy on climate change and nature preservation to facilitate the transition in just and sustainable ways. G20 members, working closely with the business community, should commit to carbon emission reduction measures, such as carbon pricing, compliance and voluntary carbon markets and disclosure of carbon footprints, a wider adoption of circular economy principles, and the inclusion of climate adaptation measures in governments' strategic plans, in accordance with the Paris Agreement framework. To foster a more comprehensive just transition, the G20 should be careful to include the countries and communities that will be most disrupted by the adoption of carbon-neutral economy models.

[20] *"Scaling 36 solutions to halve emissions by 2030", Exponential Roadmap Initiative, 2019.*
[21] *In Figure 5, "pre-industrial level" refers to the reference period 1850-1900, identified by the IPCC in his "Frequently Asked Questions" report*
[22] *United Nations – Department of Economic and Social Affairs*
[23] *"Urban Development", World Bank Group*
[24] *"Why Cities", C40 Cities Climate Leadership Group*
[25] *"Destruction of nature is as big a threat to humanity as climate change", NewScientists, May, 6, 2019*
[26] *"Global Assessment Report on Biodiversity and Ecosystem Services", Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), 2019*

Another key element will be the shared commitment to a sustainable transformation of cities in a post-pandemic world and support for those business models compatible with the carbon-neutrality objectives of cities as part of the solution. To help prevent and manage global emergencies, G20 governments should enhance low-carbon and circularity processes with regulatory and financial incentives for sustainable urban development.
We are monitoring the COP26 work and asking the G20 to ensure the consistency of commitments across international venues.

Policy Action 1.1: Commit to and set clear pathways to a sustainable and just transition

To accelerate the transition to a carbon-neutral, environmentally sustainable and inclusive economy and deliver on Paris Agreement goals, G20 members should encourage the financing and development of climate mitigation measures such as carbon-reducing technology and carbon markets, and incentivize sustainable research and development, investments, consumption and production choices. At the same time, G20 members should develop initiatives to support the transition towards carbon-neutral solutions of countries, regions, industries, communities and workers that are experiencing barriers in the adoption of sustainable and carbon-neutral economy models. In this context, we identify the following actions as the most urgent:

1.1.1 Adopt policy measures, including fiscal stimuli and market incentives, to boost resource efficiency, speed the energy transition and support long-term investments;

The G20 should promote global coordination on policy measures, including public-private investments and fiscal incentives, and encourage adoption at the country level. Policymakers should define clear sustainability and transition strategies at a national level in accordance with the Paris Agreement and each country's National Determined Contributions (NDCs) by defining pragmatic but ambitious strategies, roadmaps and targets.

Each country's strategy should be based on three systemic imperatives: environmental sustainability; energy security and access; and economic development and competitiveness. The WEF has identified six enabling dimensions to achieve energy transition and resource efficiency: regulation and political commitment; governance and institutions; infrastructure and innovative business environment; human capital and consumer participation; energy system structure; and capital investments[27].

We see a predictable and reliable regulatory framework as a key lever to accelerate the transition by creating fair and attractive market conditions on a global scale. A proper and stable regulatory framework will define the playing fields for the private sector, and encourage long-term investment such as in more energy-efficient production processes or in renewables generation technologies. Fiscal stimuli for long-term investments might also help in the initial phase of a newly developed technology until it is available at competitive prices. Regulation disincentivizing longer-term investments, such as the IFRS 9, should be addressed and revised, as outlined by Recommendation 2 of the Policy Paper by the Finance & Infrastructure Task Force.

[27] *"Fostering Effective Energy Transition: A Fact Based Framework to Support Decision Making", WEF, 2018*

Policymakers have several levers, including: implementing green procurement principles (for example, energy-linked parameters in private/public procurement tenders); stimulating private companies to disclose and improve ESG performance (for example, use of open data platforms to measure and disclose company ESG performance) also through tax benefits mechanisms or mandatory frameworks; promoting public-private partnerships and ventures such as EU JESSICA Urban Development Funds, to enable and de-risk investments; scaling the adoption of new technology to decarbonize energy such as clean energy and advanced power storage solutions[28]; promoting green certificates; enabling the development of carbon-trading markets; and proposing international principles to stimulate the integration of environmental considerations in public investments, such as the G20 Principles for Quality Infrastructure Investments, and boost sustainable development financing, such as the UN Declaration on Innovative Financing for Development.

The G20 should ensure that regulatory frameworks minimize bureaucratic burdens, which can be an obstacle especially for SMEs, to foster the adoption of the measures on a large scale.

The G20 should also help disseminate information about just transition initiatives already underway, such as the EU Just Transition Mechanism for financing schemes, the Solidarity and Just Transition Silesia Declaration signed by 50 countries at COP24 for workforce repurposing, and the Climate Action for Jobs Initiative for the creation of decent green jobs.

Open-es – A platform for the sustainable development of supply chains

Open-es is a digital platform that connects companies and organizations across industries to measure and improve ESG performance.

The platform "powered" by Eni is a new private-led initiative open to all companies and aimed at promoting the sustainable development of industrial production chains.

Open-es has a distinctive approach in which ESG data disclosure and transparency is intended as a competitive success factor, favoring the growth of the entire ecosystem. The platform has been released on March 2021 and in the first two months more than 1,600 companies joined the community and also other leading companies are currently evaluating the opportunity to engage their supply chain on Open-es.

Open-es allows all players in the industrial ecosystem and along the entire value chain to: i) measure sustainable development performance through a flexible model based on WEF Stakeholder Capitalism Metrics; ii) share ESG data, information and experiences with their clients, to increase disclosure and create business opportunities; iii) receive a gap analyses (compared to reference data by industry) as benchmarks to identify opportunities for improvement; iv) acquire services directly offered by the platform to fill identified gaps.

The promotion of an "open data approach" on ESG performance can mark an important step towards creating a transparent ecosystem, enhancing strong synergies throughout business processes and accelerating progress towards climate targets and a just energy transition.

[28] *"How the circular economy tackles climate change", Ellen Macarthur Foundation, Sept. 2019*

1.1.2 Support the development and coexistence of compliance and voluntary carbon markets to help drive investments in carbon-reducing technology and nature-based solutions that preserve biodiversity and sequester carbon, and to advance the energy transition while minimizing the costs to vulnerable communities and supporting economic growth;

Carbon pricing and compliance carbon markets

The G20 should support the adoption of local carbon pricing regulation, including explicit and implicit carbon pricing[29], in accordance with global frameworks while taking into account local market peculiarities. Article 6 of the Paris Agreement can provide a shared framework for compliance market structures, such as the European Emission Trading System and other industry-specific markets such as CORSIA for the aviation sector and the Low Carbon Fuel Standard in California's transportation sector. The G20 should promote the adoption of carbon market pricing systems, such as emissions trading systems, carbon taxes, carbon-border adjustment mechanisms and carbon offset mechanisms, such as the Joint-Crediting Mechanism, to discourage emissions and reduce the overall burden of compliance, across a wider range of sectors and increase cooperation across international jurisdictions. A coordinated global approach is required to avoid market distortions and unfair competition among states. On carbon pricing, see also Recommendation 3 of the Policy Paper by the Energy and Resource Efficiency Task Force.

Voluntary Carbon Markets (VCM)

As more corporations set voluntary net-zero and carbon-neutral targets, carbon offsets will play an important role channeling investments into net technologies and nature-based solutions that will avoid, reduce or remove carbon. Voluntary carbon offsetting has the potential to unleash large amounts of capital for financing clean technologies and nature-based solutions for carbon sequestration.

The G20 should encourage countries to promote voluntary carbon markets in line with globally accepted standards and to allow the use of voluntary carbon credits within national and subnational compliance schemes. To enable VCM practices, coordinated action is critical, including setting shared core carbon principles and taxonomy, creating core carbon reference contracts, developing a resilient, flexible and large-scale infrastructure for trade, post-trade, financing and data purposes, setting a consensus principles for offsetting legitimacy, and developing market integrity assurance.

Taskforce for Scaling Voluntary Carbon Markets

The Taskforce on Scaling Voluntary Carbon Markets (TSVCM) is an example of an initiative led by the private sector that provides a blueprint for G20 countries to implement and develop VCM trading hubs to help companies facilitate their own net-zero targets and funding for carbon-reduction and sequestration activities around the world.

The Taskforce was founded by Mark Carney, UN Special Envoy for Climate Action and Finance Advisor to British Prime Minister Boris Johnson for COP26.

To help create a scalable global market for voluntary carbon markets, the taskforce has drafted a blueprint to connect carbon credits supply to demand in a seamless, cost-effective and transparent way that builds confidence and instills credibility in the carbon credits being traded. The blueprint can be scaled

[29] *The OECD defines explicit carbon pricing direct measures, such as carbon taxes or emission-trading systems, and implicit measures, such as abatement incentives embedded in other policies that influence greenhouse gas emissions, such as gasoline taxes ("Effective Carbon Prices", OECD, Nov. 2013)*

to meet rising demand as more companies align their business models with the goals of the Paris Agreement.

In Phase 1, concluded in January 2021, the taskforce addressed: 1) core carbon principles and taxonomy; 2) standardized reference contracts; 3) market infrastructure and data; 4) legitimacy of off-sets; 5) market integrity; and 6) demand signals.

Since March 2021, the taskforce has been moving to Phase 2, creating working groups to drive stakeholder engagement, define governance, standardize documentation, legal principles and contracts, and improve carbon credit-level integrity by defining Core Carbon Principles (CCPs), additional attributes and development assessment frameworks.

To help develop a stock exchange for a voluntary market, CME Group collaborated with CBL Markets to launch a Global Offset Emission (GEO) futures contract for delivery of CORSIA-eligible voluntary carbon offset credits from three registries: Verified Carbon Standard (VCS), American Carbon Registry (ACR), and Climate Action Reserve (CAR). This contract helps the global market base access standardized and validated instruments for the emerging voluntary emissions market. CBL Markets says it will soon launch a Nature-Based Global Emissions Offset (N-GEO) contract, composed of Agriculture, Forestry, and Other Land Use (AFOLU) projects with additional Climate, Community, and Biodiversity (CCB) accreditation. The N-GEO will provide a benchmark for nature-based emissions offsets, allowing companies to meet climate commitments, while promoting the biodiversity of natural environments and supporting developing communities.

Complementary supporting mechanisms for low-carbon technologies
Although carbon price policies are crucial to reach the energy transition targets, complementary supporting mechanisms are needed to foster investment in low-carbon technologies. In particular, long-term contracting mechanisms should be put in place as hedging instruments for operators investing in new technologies and processes, such as low-carbon hydrogen production and storage. Possible options, already available for renewable power technologies, are contracts for differences, for instance linked to the carbon price. If well designed, these could be adequate de-risking instruments while maintaining proper incentives for the efficient use of assets.

1.1.3 Support the transition to zero emissions by promoting measures to sustain the technology shift and enhance R&D programs on pragmatic paths, including sustainable biofuels, natural and green gas, carbon capture and conversion, and low-carbon hydrogen, to abate emissions immediately;

The G20 should promote R&D programs in cooperation with the public sector, and provide incentives for the use of alternative fuels, including biofuels, natural and green gas, low-carbon and green hydrogen, and carbon capture and conversion technologies to reduce CO2 emissions[30].

Sustainable biofuels
The G20 should promote the development of advanced biofuel technologies, which have a large untapped potential. "Conventional" biofuels are those

[30] "Energy Transition 101: Getting back to basics for transitioning to a low-carbon economy", WEF, July 2020

produced from food crop feedstocks such as sugar cane ethanol, starch-based ethanol, fatty acid methyl ester (FAME), straight vegetable oil (SVO) and used cooking oil (UCO). "Advanced" biofuels are produced from non-food crop feedstocks, capable of delivering significant lifecycle greenhouse gas emissions savings compared with fossil fuel alternatives, and which do not directly compete with food or feed crops for agricultural land or cause adverse sustainability impacts[31]. Advanced biofuels, mainly biogas and biomethane, also include those produced from agro-industrial waste from the food processing chain such as sugarcane straws, corn straws and other agricultural residuals and the organic fraction municipal solid waste. Alternative fuels are already in use in road transport, railways, aviation and waterborne transport and can help drive emissions abatement.

Second-generation ethanol in Brazil from sugarcane straws

Residues turned into second-generation ethanol help to produce renewable energy and use resources in a sustainable way.

In Brazil, sugar cane residues are now collected, baled and stored, rather than left in the field or burned, and are transformed into ethanol and other renewable products. This is possible thanks to the technologies developed by GranBio and Raízen.

GranBio and Raízen maintain alliances with first-generation plants to supply the raw material, a critical competitive factor for the production of renewables. For example, GranBio developed a system for collecting, storing and processing sugar cane straws equivalent to 200,000 tons per year to feed the biorefinery in the state of Alagoas, which produces the lowest carbon-footprint biofuel available. It is the largest plant of its kind in the world, with a capacity of 30 million liters per year.

The process does not compromise sugar cane crops and is possible only in areas where harvesting is mechanized.

Initiatives such as Second-Generation Ethanol GranBio Biotech are supported by Brazilian regulations including RenovaBio, the Brazilian National Biofuel Policy, instituted by Law No. 13,576/2017. The regulation provides an important contribution to the fulfillment of the commitments determined by Brazil under the Paris Agreement and promote the expansion of biofuels in the energy matrix, with an emphasis on regular supply.

Carbon capture

Carbon capture, use and storage (CCUS) technologies harness CO2 from fuel combustion or industrial processes, transport this CO2 mainly by ship or pipeline, and either use it to create valuable products or services, or permanently store it deep underground in geological formations. CCUS technologies also provide the foundation for carbon removal or "negative emissions" when the CO2 comes from bio-based processes or directly from the atmosphere.

CCUS technologies contribute to clean energy transitions in several ways: (i) tackling emissions from existing energy infrastructure by retrofitting power and industrial plants; (ii) offering a solution, virtually the only one, for deep emission reductions from heavy industries; (iii) supporting the development of low-carbon hydrogen production; and (iv) removing carbon from the atmosphere[32]. CCUS needs more specific government incentives, including

[31] "World Energy Outlook 2020", International Energy Agency, Oct. 2020

financial schemes to overcome commercial barriers, which could support investments and plant operations for a limited time. However, incentives should be eventually defined according to firms' ability to reduce CO2 emissions. Momentum is growing for CCUS, after years of a declining investment pipeline, with several plans for new integrated CCUS facilities announced since 2017 (see the Box "Oil and Gas Climate Initiative CCUS KickStarter" in the Annex).

Policymakers should adopt a shared global framework of guidelines and incentives based on existing agreements to scale technologies across relevant sectors. The Carbon Capture and Storage Legal and Regulatory Indicator (CCS-LRI) represents a global initiative offering a detailed examination and assessment of national legal and regulatory frameworks that support CCS deployment and a comprehensive model for tracking opportunities for the development of global frameworks[33].

Hydrogen

The G20 should promote the development of reliable hydrogen supply chain infrastructure to meet hydrogen demand, which the IEA expects to quadruple by 2050[34]. This growth will be driven mainly by new hydrogen uses across sectors, from hard-to-abate industrial sectors to transportation (especially heavy road and long-haul transportation, where the electric solution is not technologically viable and, in the long term, for maritime and air mobility), and in ammonia and methanol production. As they become cost-competitive, green and blue hydrogen should progressively replace grey hydrogen[35]. Due to hydrogen's intrinsic characteristics, including its flammability and low density, which make it easily dispersed into the air, the G20 should incentivize investments in hydrogen, ammonia and methanol infrastructures, enabling upstream, midstream (including logistics and trading) and downstream operations.

1.1.4 Incentivize sustainable investments in low-emission, resource-efficient and climate-resilient infrastructure, including in developing countries to support local growth, and in developed countries to support infrastructure upgrades, improving economic diversification and access to cleaner and renewable energy;

The G20 should offer incentives for investments in infrastructure development, including modernizing, upgrading or extending existing systems, supporting sustainable transitions and carbon-neutral energy mixes. Hydro, solar, wind, green hydrogen and other forms of renewable energy are taking share from fossil fuels; 71% of the countries that have signed the Paris Agreement have quantified renewable energy targets for 2030 in their Nationally Determined Contributions (NDCs)[37]. Developing renewable energy poses additional challenges along the value chain. In terms of transmission and distribution infrastructure, power grids are evolving into more complex systems with decentralized generation and bi-directional power flows. In terms of technology advances, electrification and variability supply, advanced storage systems such as hydropower plants with reservoirs, or in connection with on site-renewables such floating PV systems, or other advanced battery

[32] *"CCUS in Clean Energy Transitions, Part of Energy Technology Perspectives Report", IEA, 2020*
[33] *"Legal and regulatory indicator: A global assessment of national legal and regulatory regimes for carbon capture and storage", Global CCS Institute, Sept. 2015*
[34] *IEA, 2020 – Global hydrogen demand by sector in the Sustainable Development Scenario, 2019-2070*
[35] *Grey hydrogen is produced using fossil fuels such as natural gas. In blue hydrogen, carbon emissions are*
[36] *Upstream operations focus on production, midstream operations on transportation and storage, and downstream operations on refining and marketing. For more information, please visit: https://guides.loc.gov/oil-and-gas-industry/companies*
[37] *"Renewable Energy and Climate Pledges: Five years after the Paris Agreement", International Renewable Energy Agency, Dec. 2020*

energy storage systems are required.

New investments will be needed to adapt and develop the electricity grid infrastructure backbone. Upgrades will enable the integration of new renewable generation capacity in the system and create new links between urban and rural areas. Storage systems will be needed to compensate for the volatility of renewables and balance supply and demand. The G20 should promote investments in low-carbon generation, transmission and distribution infrastructure and support innovation to enable the transition, such as through public-private research projects or joint ventures.

The G20 should promote and accelerate the transition towards the digitization of industrial processes, aimed at introducing technologies such as the IoT, sensors and actuators, cloud solutions and additive manufacturing, to support more energy-efficient and sustainable production processes. Moreover, the G20 should promote the development of sustainable agricultural mechanization to enhance food security and availability, especially in developing countries. Sustainable mechanization will improve productivity, help farmers use resources more efficiently, enhance market access and help mitigate climate-related hazards[38]. The G20 should also incentivize the adoption of digital solutions such as of precision agriculture and digital farming (see the Box "ConectarAGRO" in the Annex). Combining precision farming technology such as drones and improved satellite imaging with intelligent networks (IoT, smart devices, AI) and data management tools, farmers will produce more food with less land, water, fertilizer and fewer seeds while protecting the environment.

Since digital tools have the potential to considerably exploit resource-efficient opportunities in different sectors, the G20 should foster further investments in other enabling technologies, including AI, big data, analytics and 5G, as outlined by Recommendation 3 of the Policy Paper by the Digital Transformation Task Force.

1.1.5 Encourage a more resilient and decentralized urban infrastructure, such as district heating and cooling (DHC) and on-site renewable generation, to balance energy supply and demand, water distribution and access;

More cities are now starting points and laboratories for a wide range of economic, social and sustainability experiments that promise environmental, social and economic benefits. G20 governments should encourage city and urban plans for more resilient and "complete neighborhoods," where residents can access all their essential needs quickly through sustainable and decentralized infrastructures, considering each country's unique context and infrastructure.

New urban green spaces, the use of renewables, more energy-efficient buildings and plants, digitalization, waste recycling, biofuels, sustainable mobility and other new technologies can provide energy savings and tangible reductions of CO2 emissions. G20 countries should recalibrate the relationship between city and nature, promote proximity and improve accessibility by revisiting public spaces, urban design and planning and the negative externalities of agglomerations[39].

In this process, the private sector can make technological capabilities and innovations available to all areas of production to extend the lifespans of

[38] *"Sustainable Agricultural Mechanization", Food and Agriculture Organization of the UN*
[39] *"Policy Responses to Coronavirus (COVID-19): Cities policy responses", OECD, July 23, 2020*

products and save materials and other resources. Companies can share their experience in remediating and reusing water and soil, and other innovations that can help cities save resources and improve overall energy efficiency.

Actions and policies, including appropriate regulations, should be developed to change consumers' behaviors to support efficient energy use and transition towards the use of green and sustainable energy sources.

G20 countries should provide incentives to decentralize urban infrastructure to mitigate greenhouse gas emissions and improve energy and water security. A decentralized urban infrastructure strategy has several positive implications, including the deployment of renewable energy, the reduction of the risk associated with relying on single providers for energy, water and other resources, and the creation of more competitive resource markets in the long run. In particular, the G20 should support the development and modernization of green DHC networks and promote the acceleration of urban and industrial decarbonization, when appropriate.

The G20 should also enhance the development of on-site renewable generation by facilitating a competitive and fair market through appropriate regulation. On-site renewable generation will include low-carbon technologies such as solar photovoltaic, solar thermal, wind turbines, geothermal stations, marine energy and waste-to-energy solutions such as urban waste processing and biomethane gas production. The G20 should accelerate this transition by adopting financial incentives such as tax incentives and solar renewable energy credits, or by facilitating financing options such as power purchase agreements, leasing and project finance.

As decentralized networks and on-site generation expand, governments must support local supply and demand balancing mechanisms, such as the sale of excess power to the network and direct power sales to customers. Coordinating transmission system operators and distribution system operators will help cities manage the flexibility of distributed resources. Since public-private partnerships with local governments are an important lever, the G20 should promote the development of integrated energy platforms designed to guarantee flexibility for decentralized energy sources. This would allow effective management of the new distributed resources and the coordination and participation of all the stakeholders in new electricity systems.

As an overarching goal, governments should encourage the optimization of production and supply chain processes and make larger use of digitalization opportunities such as smart metering, IoT and AI.

1.1.6 Enhance the development of circular economy and nature-based solutions to achieve sustainability, accelerate the transition and preserve biodiversity;

The G20 should foster the adoption of circular economy practices, characterized by innovation and high technological capabilities, and nature-based solutions to reduce environmental impacts and preserve and regenerate natural ecosystems.

As defined by the Ellen MacArthur Foundation, the circular economy is a "systemic approach to economic development designed to benefit businesses, society, and the environment. In contrast to the 'take-make-waste' linear

model, a circular economy is regenerative by design and aims to gradually decouple growth from the consumption of finite resources." This concept is based on closing loops around extraction, production, and consumption systems; resources, materials and products use is maximized within the loop for the longest time possible, minimizing or eliminating waste across systems. The G20 should promote partnerships, such as the Global Alliance on Circular Economy and Resource Efficiency and the Platform for Accelerating the Circular Economy (PACE), to advance initiatives related to circular economy transition and sustainable consumption and production. The alliances should bring together private and public sector players to identify gaps in knowledge and governance to enable the circular economy transition.

The G20 should encourage the transition towards circular business models not only to meet sustainable and energy transition objectives but also to create value and spur technological advances. Private organizations should aim to bring circular business models into companies' missions, commitments, targets, commercial plans and value chains. Several of those business models can create value while minimizing the use of new resources and exploiting recycled material with low carbon footprints. Circular business models and principles can be applied to any industry, including manufacturing, agriculture and forestry, energy systems, transportation and mobility, healthcare, and information and communications technology. Modern urban planning and modernization should sustain the role of cities as strategic laboratories of low-carbon societies.

In agriculture and industrial processes, for example, circular business models can help limit or eliminate waste generation (see the Box "Cestas Biomethane Circular Economy" in the Annex). Examples include material-efficient building designs; industrialized construction processes; lightweight designs for vehicles; reutilization of products and components such as through renting, sharing or pay-per-use; valorization of waste in hydrogen projects; production material recirculation, such as collection, sorting and recycling; and the adoption of nature-based or biological materials such as green building materials and biofuels, especially biomethane, as power sources for agriculture machineries[44].

To accelerate the adoption of circular business models, governments can offer tax incentives and create clearer, more consistent standards for sustainability certification, especially for SMEs. An important example in manufacturing is the lifecycle assessment (LCA) analysis, which is based on recognized international standards that could be extended to all G20 countries, thus limiting the complexity of national certifications and protocols. The convergence of existing corporate non-financial disclosure frameworks for sustainability (including circularity) reporting and for metrics measurement is already underway and detailed in policy action 1.2.1.

The G20 should take urgent action across society to put biodiversity on a path to recovery for the benefit of planet and people. Action is required at the regional, national and global levels to transform economic, social and financial models and reverse trends that have exacerbated biodiversity loss. The G20 should implement regulatory measures for public and private financial institutions and businesses to: (i) integrate biodiversity into business and financial decision-making and strategies; (ii) support business in standardizing metrics to measure and value impacts and dependencies on biodiversity; (iii) adopt disclosure requirements on biodiversity risks, impacts and opportunities. Policymakers should adopt a shared global framework for de-

[44] *"How the circular economy tackles climate change", Ellen Macarthur Foundation, Sept. 2019*

fining common guidelines and incentives for implementing the bioeconomy as a strategy for sustainable development.

Nature-based solutions (NbS) are crucial to help reduce environmental impacts and preserve and regenerate natural ecosystems. As defined by the International Union for Conservation of Nature (IUCN), NbS "are actions to protect, sustainably manage and restore natural and modified ecosystems that address societal challenges (e.g., climate change, food and water security or natural disasters) effectively and adaptively, simultaneously providing human well-being and biodiversity benefits."[45] These solutions could play an important role in reducing disaster risks and help achieve sustainable and resilient development. In some cases, NbS have a preliminary goal to mitigate climate change along with social challenges: these solutions are called NCS (Natural Climate Solutions). For example, a mangrove conservation project that addresses climate change, disaster risk prevention, environmental degradation and biodiversity loss, but may improve food security by providing shelter to fish and economic and social development by supporting sustainable fisheries and/or ecotourism[46]. This kind of project can be included under the UN REDD+ [47] scheme, which encompasses conserving forests to reduce emissions, improve the natural storage capacity of CO2, and support local communities development through socio-economic projects in line with the principles of sustainable management, forest protection and nature conservation.

Options for supporting and financing NbS include monetary and non-monetary incentives for local communities, farmers and private land owners to protect, restore and conserve natural ecosystems and adopt sustainable agricultural and other land use practices. One option still in development could be a non-fungible token (NFT)[48] market based on natural forestry preservation: landowners would be paid in digital currency for preservation. Such projects would use satellite imagery to monitor changes in natural forestry throughout the planet.

Nature-based solutions should also be promoted in water resources management. In this regard, the G20 should develop public-private water conservation initiatives, including international and supranational governance projects to improve cooperative transboundary basins management.

The G20 should promote global alliances and bring public and private sector players together to overcome obstacles to financing nature-based solutions. In this context, it would be fundamental to support the development of specific and standardized instruments to evaluate the material risks and opportunities associated with nature to attract more capital to NbS projects. For example, the Task Force on Nature-related Financial Disclosures (TNFD) "will provide a framework for corporates and financial institutions to assess, manage and report on their dependencies and impacts on nature, aiding in the appraisal of nature-related risk and the redirection of global financial flows away from nature-negative outcomes and towards nature-positive outcomes."[49] Other coalitions, such as Business for Nature and the NCS Alliance, co-hosted by the World Economic Forum and World Business Council for Sustainable Development, have been created to help scale up NbS projects.

On preserving the equilibrium of the natural ecosystem, see also Recommendation 4 of the Policy Paper by the Energy and Resource Efficiency Task Force.

[45] *Definition of nature-based solutions from the International Union for Conservation of Nature*
[46] *"Accelerating business solutions for climate and nature – Report I: Mapping nature-based solutions and natural climate solutions", World Business Council for Sustainable Development, Dec. 7, 2020*
[47] *REDD+ platform at the UN's Framework Convention on Climate Change*
[48] *"Non-fungible tokens are cryptographic assets on blockchain with unique identification codes and metadata that distinguish them from each other. Unlike cryptocurrencies, they cannot be traded or exchanged at equivalency." Definition from Investopedia website*
[49] *Bringing together a Taskforce on Nature-related Financial Disclosures, tnfd.info*

1.1.7 Encourage greater international collaboration on predictive studies and scenario analyses to better assess the impact of different types of risks;

The G20 should promote coordination on collaborative methodologies for assessing the long-term impact of physical, transition and systematic risks, and resilience. Physical risks include those arising from changes in the frequency and impact of natural events such as droughts or floods due to climate change, and made-man events such as those arising from changes in land use, infrastructure, reformed forestry industry or consumer culture that alter our exposure to climate risk. Transition risks include those arising from changes in policy, litigation, reputation, shareholder activism, energy technology during the shift to a low-carbon economy[50]. Systemic risks can emanate from all of the above or may be due to supra-regional policy changes, concentrations of exposure or hazards, and global shifts of resources and people. Resilience can be tested through system models that compare countermeasures' effects on changes in hazards and exposures. Although system models exist, much needs to be done to share, harmonize and connect data and strategies so these tools can help support decisions across all levels of society.

The G20 should promote the adoption of common climate scenarios, such as through convergence of underlying assumptions, financial modeling methodology, a shared taxonomy of potential hazards or shocks and common scenario outputs. The G20 should foster the inclusion of macroeconomic environmental factors and value chain characteristics to evaluate climate-related physical risks[51]. To this end, the UNEP Finance initiative is working with Carbon Delta to coordinate a group of 20 investors to test scenario-based analyses of their portfolios in line with recommendations of Task Force on Climate-related Financial Disclosures.

Comprehensive data and a long-term program for global observations, such as satellite earth observation, are critical for predictive scenario analysis, early warning systems and effective resilience (see also policy action 1.2.2)[52]. With regards to data, the Insurance Development Forum (IDF) is leading the industry in an open source (data) modelling collaboration in order to develop interoperability between models and platforms, and develop open data standards for exposure data.

(Re)Insurance solutions are paramount to calculate, share and assume risk while sharing ideas about risk management and mitigation and helping to create an infrastructure for risk communication and sharing from homeowners over larger commercial organizations to investors and governments. Resilience models should be launched and further evolved including all of the above in order to understand cost-benefit of action and how best risk can be shared across all levels over the next decades. Understanding the systemic nature and long-term effects of climate policy and change will help mitigate risk and foster communication, informed planning and decision making across all levels of society.

European Extreme Events Climate Index[53]

The European Extreme Events Climate Index (E3CI) is a metric to evaluate and manage the impact of extreme atmospheric phenomena, developed by Unipol Group as part of the International Foundation Big Data and Artificial Intelligence for Human Development (IFAB) project, in collaboration with the Euro-Mediterranean Centre on Climate Change (CMCC) and Leithà.

[50] *"An Investor Guide to Physical Climate Risk & Resilience", Global Adaptation & Resilience Investment Working Group, Nov. 2017*
[51] *"Changing Course: A comprehensive investor guide to scenario-based methods for climate risk assessment, in response to the TCFD," UN Environment Program Finance Initiative, May 2019*
[52] *"A vision for managing natural disaster risk", WEF, April 2011*
[53] *For details, please visit the Unipol Group website*

The E3CI facilitates the identification of the damages caused by whether events and the estimation of their severity, for example supporting insurance, reinsurance and finance players in climate-related insurance products pricing and risk management.

Developed on the basis of the North American Actuaries Climate Index, the E3CI includes five components: cold stress, heat stress, drought, extreme precipitations and extreme winds.

Initiatives such as the E3CI represent a significant step towards the objectivization of weather events impact estimation and, therefore, the creation of a transparent market for climate-related risks.

1.1.8 Supporting risk preparedness and preventions of companies against all kinds of hazards with the aim to guarantee business continuity and strengthen long-term resilience;

The G20 should help companies adopt risk assessment practices and prevention measures, and foster business preparedness and resilience against environmental risks. In particular, the G20 should promote the adoption by firms of business continuity plans, risk management practices, training programs and investments to strengthen physical assets, plants and facilities against calamitous events such as floods and fires. For example, the UNDRR has identified guidelines to help SMEs improve resilience against multiple hazards through preventive activities[54]. Moreover, the G20 should also promote partnerships between public organizations and industry associations, such as the already existing cooperation between UNDRR and ICMIF in the insurance industry, to stimulate the identification and diffusion of sustainability best practices (see the Box " The Emergency Management Programme" in the Annex).

Firms' ability to reduce disaster risks not only improves their own competitiveness but also community resilience and innovation. Using IoT in construction, for example, can increase resilience against adverse events.

The G20 should adopt stable medium- and long-term policy measures, such as tax credits and grants, and incentivize public-private partnerships to help companies assess risks and take preventive measures (see the Box "LIFE DERRIS" in the Annex). The G20 should also support public-private investments in local infrastructure, including roads and bridges, which are critical to supply chains and can help protect community assets from environmental risks.

1.1.9 Promote educational and vocational programs on sustainability and just transition to raise community awareness, develop knowhow and technical skills, and foster social inclusiveness.

Education and training play crucial roles in the just transition. In particular, the G20 should target two macro-objectives through differentiated policy actions. First, the G20 should aim at increasing environmental and sustainability awareness throughout society, from the first levels of education to adults. Awareness across a broad spectrum of the population would allow behavioral changes that are essential to the transition and the diffusion of circular economy practices and NbS, and it would foster bottom-up, grassroots initiatives that can accelerate the transition itself.

[54] *"Reducing risk & building resilience of SMEs to disasters", UN Office for Disaster Risk Reduction, 2020*

The G20 should also support appropriate educational and vocational programs to develop the wide range of new skills needed to:

• develop environmentally friendly technologies, production processes, products, services and business models across all sectors of the economy;
• perform traditional jobs in the new context of the low carbon economy;
• upskill or reskill workers prepare workers to do new green jobs.

Raising awareness, developing new skills and providing upskilling and reskilling opportunities are essential steps for a just and inclusive transition. Inclusiveness should be viewed not only as a goal but also as a strategy to enhance the economic and social potential of nations. The G20 should reorient their education systems to build a global economy that ensures long-term sustainable development and resilience to economic shocks, and tackles social challenges of our times. Climate change, frequent natural disasters, poverty, and dramatic social inequities are just some of the unprecedented challenges the global community faces today. Education is a key to encouraging learners to become "change agents" with the knowledge, means and will to find solutions for these challenges. Education is also key to setting a strong basis for a global support on ambitious public policies oriented on sustainability, equality, diversity and inclusion. Policymakers can take actions to reorient education towards sustainability, including: financial support and incentives to develop sustainability-oriented educational and training initiatives; policies and regulations to include sustainability and environmental topics as mandatory at all levels of education; schemes to prepare teachers to educate for sustainable development; frameworks and guidelines to support the design and implementation of educational and training initiatives that integrate priority sustainable development issues into teaching and learning, such as in the Education for Sustainable Development initiative promoted by UNESCO[55].

Policy Action 1.2: Promote the consistency of environmental sustainability reporting standards and reinforce global governance to enhance technological innovation

G20 members should promote harmonization and improve the transparency of existing non-financial disclosure standards to help allocate sustainable financing more efficiently, and reinforce global governance to speed innovation for environmental disaster management. We recommend that the G20:

1.2.1 Promote the convergence and harmonization of existing corporate non-financial disclosure frameworks to create transparent, globally accepted standards for environmental sustainability reporting and measurement practices, with "stakeholder capitalism"[56] as an overarching perspective;

The G20 should promote the international convergence and harmonization of non-financial disclosure frameworks, such as CDP and CDSB, taxonomies and standards, such as GRI, SASB and IR. Sustainability metrics, models and methodologies need to be harmonized and made more transparent to inform investment outcomes, better understand economic activities' impacts on people and planet, and drive capital allocation to where it is needed most.

[55] *"What UNESCO Does on Education for Sustainable Development", UNESCO*
[56] *In "stakeholder capitalism," companies create long-term value by taking into account the needs of all stakeholders, including society at large*

As such, the G20 should ask market and prudential authorities to work towards the alignment of ESG disclosure frameworks (see also Recommendation 1 of the Policy Paper by the Finance and Infrastructure Task Force), involving global standard-setting bodies in the process. A harmonized framework should set clear reporting guidelines, shared governance principles and universal, industry-agnostic metrics. The framework should address company-specific "core metrics" as well as "expanded indicators" for a wider value-chain scope, as promoted in the WEF-IBC "Stakeholder Capitalism Metrics" initiative. To this end, the G20 should incentivize non-financial disclosure and certification schemes that recognize companies' commitment towards the entire value chain, such as in Ireland's sustainable program "Origin Green" for the food and drink industry.

More effort is required to increase, improve and harmonize data and disclosures from all sectors of the economy, in particular from emerging markets, which are the most at risk from climate change and represent some of the biggest investment opportunities.

Information transparency is improving, thanks to initiatives such as the Task Force on Climate-related Financial Disclosures (see the Box "Task Force on Climate-related Financial Disclosures (TCFD)" in the Annex), CDP and CDSB Framework. However, the quality and consistency of broader sustainability data is often poor, non-comparable and inconsistently disclosed.

Internationally, fragmentation undermines progress. The proliferation of taxonomies, for example, prevents interoperability, increases compliance burdens on companies operating across multiple markets, and ultimately prevents global sustainable capital mobility. At the global level, the International Platform on Sustainable Finance has great promise in improving convergence: its ultimate goal is to "scale up the mobilization of private capital towards environmentally sustainable investments."[57]

The G20 should promote clear and practical methodologies for metrics to preserve trust and sustainability information assurance. Accredited auditing firms or certification agencies should verify the information and value of non-financial disclosure frameworks and enable companies to report in more consistent and comparable ways.

A shared and transparent non-financial sustainability reporting framework will foster transparency and trust among corporations, investors and other stakeholders. Transparency will be a key to advancing a global sustainable finance approach and driving investment decisions more efficiently. According to the World Bank, "investors are becoming more conscious of the effects of their economic footprints and the benefits of integrating sustainability, mainly by adding ESG considerations, into investment decisions."[58] Common reporting and metrics are important, but it is also important to converge on standards that describe environmentally positive and socially sustainable activity. The G20 should support the development of such standards to promote cross-border investments.

Policymakers should rely on a mix of instruments to promote framework adoption, depending on each company's characteristics. Disclosure requirements, for example, could be required for listed companies, while small and medium-sized companies could have fiscal incentives and simplified sustainability reporting frameworks for voluntary adoption.

[57] *European Commission International platform on sustainable finance*
[58] *"Riding the Wave: Navigating the ESG Landscape for Sovereign Debt Managers", World Bank Group, 2020*

WEF-IBC Stakeholder Capitalism Metrics

The WEF-IBC is already leading this effort alongside more than 60 global business leaders committed to aligning their corporate goals with ESG principles. The Stakeholder Capitalism Metrics released by the WEF-IBC, drawn from existing voluntary standards, include 21 "core" metrics, defined as "universal, comparable core disclosures focused on people, planet, prosperity and principles of governance that are considered most critical for business, society and the planet, and that companies can report on regardless of industry or region[59]." The initiative aims to enhance transparency and accountability on sustainability, and provide measurable, monitorable and comparable standards and governance principles that will benefit companies and investors. The organizations involved have committed to report the metrics to investors and stakeholders in annual reports, proxy statements and so on, publicly support the initiative and encourage their business partners to adopt it, and promote the harmonization of sustainability standards and frameworks to create a globally accepted solution for non-financial reporting.

1.2.2 Reinforce global governance and coordination with public-private partnerships, and establish an integrated strategy to identify, develop and share innovative technologies and best practices for environmental risk and disaster management;

The G20 should recognize the critical role of innovation and technology in environmental disaster management, reinforcing global coordination and commitments to existing frameworks, such as the technology framework under Article 10, paragraph 4, of the Paris Agreement. The G20 should promote global initiatives, including research programs, joint ventures and pilot projects, leveraging public-private knowhow and resources. Some global mechanisms are already in place, including the Technology Mechanism established in 2010 by COP that created two bodies that work together: the Technology Executive Committee (TEC) and the Climate Technology Centre and Network (CTCN)[60]. TEC identifies policies to accelerate the development of low-emission and climate-resilient technologies; CTNC promotes the development and transfer of climate technologies by providing technical assistance and access to information about climate technologies and by fostering collaboration among climate technology stakeholders[61]. Moreover, the G20 should incentivize public-private partnerships aimed at developing and promoting sustainable technologies to improve environmental risks data collection and monitoring.

Space technology, for example, could help achieve these objectives. The G20 should extend its access on a global scale and promote Free and Open Access regulations, such as EU Copernicus, especially in the interest of less-developed countries. Natural disaster management in all its phases could benefit considerably from space assets. Earth observation from space improves modeling and weather forecasting, helps to predict environmental catastrophes, and provides early warnings. Satellites are reliable tools for communication, mapping and positioning on a global scale, and vital for relief and recovery, assessing damages, locating those in need and delivering first aid.

Moreover, the G20 should promote initiatives aimed at ameliorating humanitarian operations and logistics, involving different stakeholders, such as public agencies, non-governmental organizations and companies. For example, the UN agencies and the Pan American Health Organization developed a joint instrument, called Logistics Support System (LSS), to facilitate and improve coordination at national and international level among all interested humanitarian partners.

[59] *"Global Business Leaders Support ESG Convergence by Committing to Stakeholder Capitalism Metrics", WEF, Jan. 26, 2021*
[60] *"What is technology development and transfer?", UN Framework Convention on Climate Change*
[61] *For details, visit the websites of the Climate Technology Centre & Network and Technology Executive Committee at the UNFCC*

Policy Action 1.3: Enhance emergency recovery and financing schemes

G20 members should cooperate to create worldwide recovery and financing schemes that facilitate fast and targeted relief where it is needed the most with green, sustainable and equitable approaches, turning climate and environmental challenges into opportunities. In particular, they should:

1.3.1 Promote collaborative public-private partnerships among financiers, investors and responders to share data and technical knowledge and to provide economic relief, also through innovative post-disaster financing mechanisms;

The G20 should adopt a disaster risk management strategy based on public and private partnerships among national and international bodies, such as, disaster management agencies, civil protection and environmental ministries, and investors, insurers, reinsurers and banks. The private sector has a crucial role in providing capital and technical expertise, and driving innovation in prevention and post-disaster financing mechanisms for large companies and SMEs.

The availability of risk-bearing capital in the insurance and capital markets has already allowed countries to transfer excess risk to the private sector, such as through international reinsurance companies, and outside domestic markets. Financial market development and innovations, such as catastrophe bonds and catastrophe swaps, are boosting flexibility and capital availability, allowing pension funds, for example, to invest in such innovative solutions.

Private insurers and banks can provide data, catastrophe risk modeling and other technical expertise to quantify and manage risk accumulations[62], with the appropriate recognition of costs sustained to collect and manage data. They can also participate in PPPs and encourage investment in disaster prevention, for example by offering lower premiums to reward risk-reducing behavior, thus incentivizing businesses to adopt prevention measures and contributing to risk mitigation.

Insurance companies are already offering innovative solutions for disaster risk management, including the Global Index Insurance Facility and environmental disaster-linked insurance products. GIIF, a global fund, is supporting the development of a weather and disaster index-based insurance market in developing countries, and expanding access to finance through index insurance as a risk management tool in agriculture, food security and disaster risk reduction.

1.3.2 Coordinate and promote investments to rebuild damaged infrastructures in affected countries in a sustainable and more resilient way;

The G20 should encourage the adoption of sustainable infrastructure principles, in combination with structural protection measures in infrastructure reconstruction projects, to increase resilience in environmental disasters and promote sustainable urbanization. Keys to resilience include the involvement of territorial organizations and local community capabilities in emergency management and recovery.

The G20 should promote the adoption of shared guidelines to design and implement resilience and sustainability objectives and targets into countries' master plans, standards and regulation. Infrastructure regulation should be consistent with risk-informed land use and urbanization plans to minimize

[62] *"Disaster Risk Finance Requires Public and Private Partnership", World Bank Group*

spatial development and community exposure to natural disasters. Reconstruction projects should account for risks and adopt sustainable practices in early project designs and master plans[63].

Blended finance remains an under-utilized financing mechanism. The OECD has defined it "as the strategic use of development finance and philanthropic funds to mobilize private capital flows to emerging and frontier markets.[64]" Particularly in the COVID-19 recovery phase, it can help leverage private investment towards sustainable infrastructure projects, for example, where government spending alone cannot finance all necessary rebuilding.

The G20 should continue to encourage policies that help de-risk infrastructure projects, particularly in emerging markets, where global investors are unable to make investments due to their own risk management standards. This is particularly important because some of the investments needed most find it more difficult to attract international capital due to perceived risks. The G20 should also promote better institutional coordination, capacity-building and bureaucratic streamlining to mobilize blended finance.

Examples include the Global Infrastructure Hub, a G20 initiative, and the OECD's Blended Finance Guidance.

[63] *"Lifelines: The resilient infrastructure opportunity", World Bank Group, June 19, 2019*
[64] *"Blended Finance Vol. 1: A Primer for Development Finance and Philanthropic Funders", OECD, 2015*

Recommendation 2: Enhance resilience and management against future infectious disease outbreaks

The G20 should build on COVID-19 experience to develop consistent and coordinated plans to enhance resilience and management in future pandemics, reinforcing healthcare and surveillance systems, supporting global value chains during crises, and favoring global equitable access to diagnostics, therapeutics and vaccines.

Policy Actions

2.1 Build future pandemic preparedness
G20 members should strengthen pandemic preparedness by increasing coordinated R&D efforts, reinforcing global frameworks, adopting a "One Health" approach and promoting education campaigns.

2.2 Promote global cooperation and value chain resilience during outbreaks
G20 members should reinforce global cooperation, transparency and information-sharing to manage emergencies and foster the adoption of disease-surveillance systems and advanced technology, e-Health solutions, business continuity plans, and the resilience of global value chains.

2.3 Scale up diagnostic, therapeutic and vaccine development and rollout, and adopt economic measures to speed a sustainable and inclusive recovery
G20 members should support the rapid scaling of diagnostic, therapeutic and vaccine production and equitable availability after infectious disease outbreaks, adopting clear guidelines and economic measures.

Leading Monitoring KPI	Baseline	Target
Global Health Security Index, Median[65] (0-100 scale)	37 (2019)	45-50 (2030[66])

Source: *Nuclear Threat Initiative (NTI) and the Johns Hopkins University Center for Health Security, with The Economist Intelligence Unit (EIU)*
Owner: *G20*

SDGs Impacted

Recommendation 2 contributes to five SDGs with primary effects on **SDG 3, SDG 8 and SDG 10**, proposing actions to significantly reduce the risks of global pandemics, supporting health systems, R&D, vaccines and therapy development to grant equitable access to all countries. The recommendation aims at enhancing the resiliency of global value chains in outbreaks and improve crisis management and recovery. These efforts will advance **SDG 9 and SDG 11.**

[65] *Based on a methodology that can be subject to potential revision over time; see the Annex for more details*
[66] *Depending on Index availability for 2030*

The main focus areas are targets 3.3, 3.b, 3.c and 3.d, with the intervention on R&D support, vaccine and therapy development, production, and distribution for all countries.

Actions are meant to support target 8.2, enhancing global productivity, with innovations and new models of partnership across stakeholders

Advances will be made on target 9.5 with increased R&D expenditures and support for technological innovation.

Pursuing target 10.3 will provide equal opportunities for all countries, including fair access to vaccines at affordable prices.

Primary attention is on target 11.5 to reduce and mitigate direct economic losses from infectious disease outbreaks.

3Ps Impacted

Recommendation 2 is in line with all three principles of the G20 Italian Presidency: **People, Planet and Prosperity.**

Context

The COVID-19 pandemic has presented humanity with one of its most severe challenges, with suffering and economic disruption on a global scale. The World Economic Forum estimates overall costs at $8-16 trillion[67].

The growing frequency of zoonotic infectious diseases outbreaks is alarming. In the last 200 years, about four infectious diseases[68] emerged each century, on average, four times more frequently than in the previous 2,000 years (Fig. 6). Several deadly new infectious diseases emerged in just the last two decades, including SARS, swine flu and Ebola, that may recur, especially in more vulnerable countries. While the frequency of infectious diseases has increased, the severity of the infections has been contained compared to historical pandemics, such as the Spanish flu. Globalization and greater access to information allows countries to identify causes, develop vaccines and manage crises more quickly.

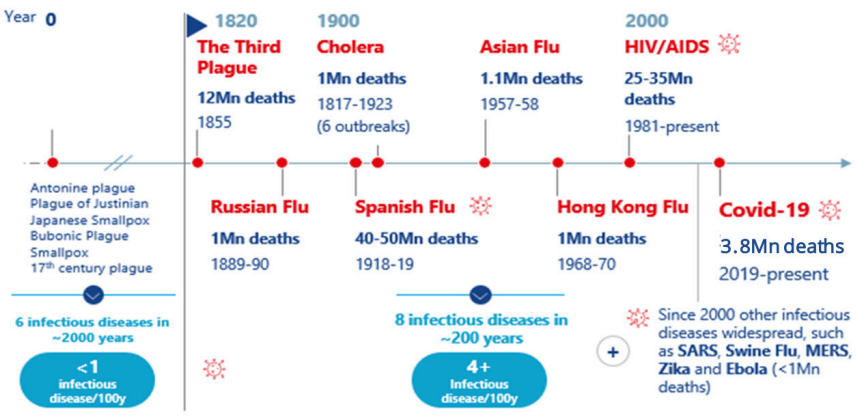


Figure 6: Major historical infectious diseases in the last 2,000 years (>1Mn), Centers for Disease Control and Prevention (CDC)[69]

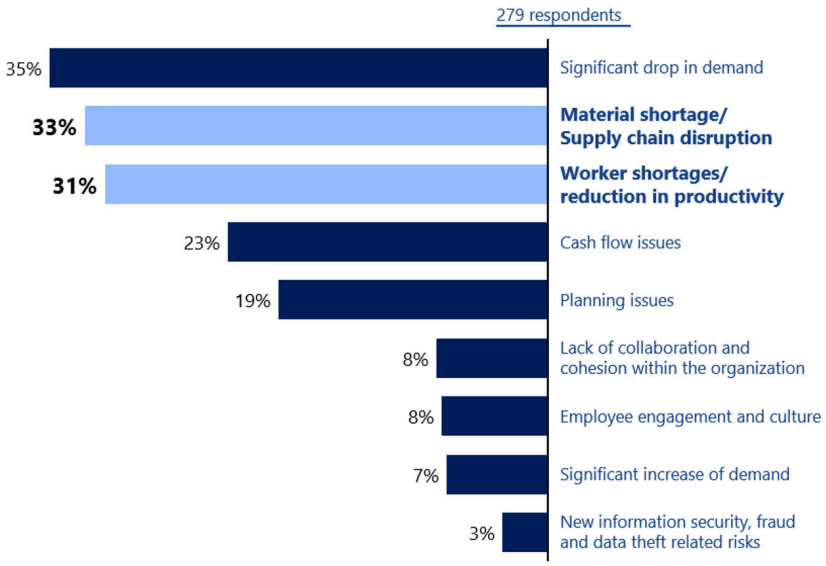
[67] *"Fighting COVID-19 could cost 500 times as much as pandemic prevention measures", WEF, Aug. 3, 2020. Total costs include global loss of gross domestic product, workforce deaths and health impairment*
[68] *Defined by the U.S. Centers for Disease Control and Prevention as those causing more than one million deaths*
[69] *Covid-19 deaths datum at the time of this writing (Coronavirus dashboard, World Health Organization)*

Investments in health still lag the rise in threats, however. Around 90% of countries[70] experienced disruption to essential health services, and 94% reassigned NCDs health ministries to face the emergency, as noted. Challenges were not limited to healthcare: a third of companies experienced significant disruptions in their supply chains, 33% had material shortages and 31% worker shortages (Fig. 7)[71].

Antibiotics are a critical tool in treating bacterial and viral disease outbreaks, such as pneumonia and other deadly comorbidities in COVID-19 patients[72]. Resistance to antibiotics is growing quickly, however, and not enough antibiotics are in development to meet current or anticipated patient needs due to a lack of commercial sustainability.[73]

To reach the post-pandemic era, a huge number of actors will need to work intensively for months and even years. Challenges range from the logistical and contractual to diplomatic. New forms of partnerships are required. Collaboration will be a crucial component of the transition to the new normal. According to early estimates, the world has sufficient manufacturing capacity for syringes and fill-finish materials. The two largest US manufacturers, for example, can produce 280 million vials each year, capable of holding up to 2.8 billion doses. But suppliers of niche chemical and biological components are scattered, and countries compete for limited resources. Many vaccine manufacturers are entering into arrangements with highly specialized partners to meet strict production regulations. These new forms of partnerships "will likely become increasingly necessary to meet global vaccine demand and will be a major determinant of the campaign's overall success"[74]. For instance, Moderna collaborated with Catalent and Lonza for fill-finish operations and active principle production. Pfizer reached an agreement with Sanofi for the production of 125 million doses of COVID-19 vaccine for EU starting in the summer of 2021.[75]

Figure 7: Global challenges faced by companies during COVID-19, McKinsey, 2020



[70] *Survey completed by 155 countries over three weeks in May 2020 (WHO)*
[71] *McKinsey COVID-19: Global Manufacturing & Supply Chain Pulse Survey*
[72] *"COVID-19 pneumonia and the appropriate use of antibiotics", Ginsburg & Klugman, Nov. 11, 2020*
[73] *"Tracking the Global Pipeline of Antibiotics in Development", Pew Charitable Trust, March 2021*
[74] *"The risks and challenges of the global COVID-19-vaccine rollout", Gaurav Agrawal et alia, Jan. 26, 2021*
[75] *"Covid, svolta di Sanofi: produrrà il vaccino Pfizer/BioNTech. 125 milioni di dosi al l'Ue dall'estate", Il Sole 24 Ore, Jan. 27, 2021*

The Action Council approach

In our recommendation 2, we strongly encourage the G20 to support and implement actions to empower global health systems. We recommend priority actions to strengthen pandemic preparedness and incentivize continuous R&D spending on effective innovation development, including antibiotics. G20 members should set forth an equitable regulatory framework facilitating new forms of partnership to scale up production massively. They should also put levers in place to guarantee the continuous operation of global value chains.

G20 governments should invest in their own national offices for pandemic preparedness and health systems and in international institutions that can foster international monitoring, collaboration and responses to epidemics and pandemics[76]. Efforts can also benefit from global coordination at a summit level, as in the extraordinary summit called by the 2020 G20 Presidency of Saudi Arabia at the outbreak of the Covid19 pandemic. Just as countries prepare for worst-case scenarios, including in civil protection services and defense spending, they need to prepare for pandemics by maintaining the readiness of science, manufacturing capacity and specific supply chains.

Policy Action 2.1: Build future pandemic preparedness

G20 members should strengthen pandemic preparedness by increasing coordinated R&D efforts, reinforcing global frameworks, adopting a "One Health" approach and promoting education campaigns. In particular, the G20 should:

2.1.1. Ensure a coordinated approach and continuous R&D investments to address infectious diseases that could result in pandemics;

The G20 should encourage a coordinated and innovative value-creation approach, including continuous investment, to fight infectious diseases[77] before crises arise. A credible commitment in strengthening preparedness should entail the allocation of a determined percentage of GDP to R&D investments against infectious diseases . G20 members should also foster contributions to global vaccine and treatment programs, such as CEPI (see the Box "The Coalition for Epidemic Preparedness Innovations (CEPI)" in the Annex) and GAVI, and support coordinated "always-on" public-private initiatives, such as platform technologies, biobanks, centralized laboratory networks, and a library of prototype vaccines, to accelerate the development of diagnostics, therapeutics and vaccines.

These efforts against known threats, such as COVID-19, are critical to containing and managing pandemics, but a coordinated effort to recognize emerging infectious diseases is crucial to building resilience and preparedness. Private companies find it difficult to estimate financial returns for investments and R&D for diseases that emerge sporadically and that could be controlled before clinical trials are completed. Governments should create regulations and incentives to reward private innovations in countering emerging infectious diseases, including research in antibiotics to strengthen our ability to respond to the threat of growing antimicrobial resistance.

Global R&D cooperation among private and public entities should aim to enhance vaccine development, such as with "vaccine printers" and self-amplifying RNA vaccine platforms, improving genomic sequencing and diagnostic testing, and developing more sustainable personal protective equipment such as biodegradable face masks.

[76] "Saudi Arabia's ruthless fight against coronavirus", UN Development Programme, May 25, 2020
[77] For a 2012 example of a possible quantitative assessment, see "Consultative Expert Working Group on Research and Development: Financing and Coordination", WHO, 2012

The need for personal protective equipment (PPE) increased dramatically during the pandemic: the market should grow from $12.9 billion annually in 2019 to about $33.4 billion by 2027, a rise of more than 158%.[78] The sustainable management of PPE is a growing area of concern. A coordinated global approach to production and the waste lifecycle should be pursued at the public and private levels.

2.1.2 Reinforce the existing global framework and guidelines to enhance pandemic preparedness at local and global levels;

G20 members should help reinforce and optimize the global framework for pandemic preparedness based on lessons learned in the COVID-19 outbreak. The framework should aim to "prevent current and future threats from infectious diseases, strengthen health service resilience [...] and improve the overall quality of health care delivery." This goal echoes the G7 Health Ministers' Meeting Communique of June 2021, focused on global health security, antimicrobial resistance, clinical trials and digital health[80].

The framework should contain clear guidelines on core components of Infection Prevention and Control (IPC) programs, applicable for any country and suitable for local adaptation. IPC guidelines should include minimum capacity and resource requirements (e.g., facilities, PPE and medical supply stockpiling), KPIs for tracking purposes, procedures to follow, and responsible actors[81]. The framework should also define emergency supply mechanisms that should be tested regularly in outbreak simulations. G20 members should encourage the adoption of Infection Prevention and Control (IPC) guidelines at the national and regional levels (see also Policy Action 2.2.1).

WHO has put in place some global initiatives such as the International Health Regulations (IHR) to promote cooperation and coordination. Countries should foster the adoption of guidelines and requirements at national and regional levels, starting with the implementation of emergency operations centers, such as National IHR Focal Points[82], to coordinate epidemiological responses.

The G20 should also support the development of a global preparedness index, modeled on the Global Health Security Index. The initiative should define clear guidelines and actions to assess and improve each country's pandemic preparedness.

G20 countries should also promote the prudent use of antibiotics in all sectors by developing or strengthening national plans for antibiotic stewardship. This aligns with the commitment made in the 2017 Leaders' Declaration on Shaping an Interconnected World[83].

2.1.3 Promote a collaborative "One Health" approach that recognizes the interconnection between people, animals, plants and their shared environment;

The G20 should foster the adoption of a One Health approach at the local and global levels. One Health, a collaborative, multisectoral, transdisciplinary approach, aims to achieve optimal health outcomes by recognizing the interconnections among people, animals, plants, and their shared environment[84].

[78] "Healthcare Personal Protective Equipment Market Expected to Reach $33.4 Billion by 2027", Allied Market Research, June 2020
[79] "Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level", World Health Organization
[80] "G7 health minister's meeting communique", Oxford, 4 June, 2021
[81] "Minimum requirements for infection prevention and control programmes", WHO, 2019
[82] International Health Regulations, WHO
[83] "Leaders' Declaration: Shaping an Interconnected World", G20 Information Centre- G20
[84] "One Health: People, Animals, and the Environment", U.S. Centers for Disease Control and Prevention, April 2016

The One Health approach dissolves conventional boundaries among disciplines and involves scientists and experts across areas, including comparative and veterinary medicine, biology, ecology, social sciences and humanities.

The G20 should promote One Health global initiatives and research programs to address critical risks such as those arising from zoonotic infectious diseases, cross-species host-switching, pathogen spill-over to humans, and pathogen spread.

The G20 should encourage the joint adoption of international legal frameworks to build capacity in human and animal health, such as the IHR and OIE standards, and assessment tools, such as the IHR Monitoring and Evaluation Framework and Performance of Veterinary Services pathway.

G20 members should also foster participation in WHO's National Bridging Workshops and field simulation exercises to support the One Health mechanisms at the country level[85].

2.1.4 Support the development of education campaigns to raise public awareness and preparedness and increase confidence in vaccines;

Education campaigns can help spread knowledge and raise awareness about the risks associated with COVID-19 and other known infectious diseases. Educational programs should help change behaviors to enhance individual willingness and ability to take preventive action and to improve emergency responses around the world. The G20 should encourage all countries to decide how best to deliver education programs, measure their effectiveness, and make improvements based on what they learnt. The G20 should also help countries share insights and knowledge about education campaigns with each other and with international institutions such as the WHO.

Education campaigns could also increase public confidence in vaccines. Messages should be targeted to specific audiences and spread at international and national levels through public and private channels: public service announcements and advertisements on television, radio, print, and digital media; government websites and media channels; conferences, seminars, expert panels and webinars; and in private companies' internal communication.

While vaccination programs are making progress, a significant share of the population is still resistant to vaccines against COVID-19 and other pathogens. Education campaigns should account for religious teaching, lack of trust in healthcare systems and science, and different educational levels.

The G20 should also promote education and training to expand the skilled workforce required to manage pandemics, and produce and distribute treatments and vaccines (see also Recommendation 1 of the Policy Paper by the Health & Life Sciences Task Force).

Policy Action 2.2: Promote global cooperation and value chains resilience during outbreaks

G20 members should reinforce global cooperation, transparency and information-sharing to manage emergencies and foster the adoption of disease-surveillance systems and advanced technology, e-Health solutions, business

[85] *"Strengthening collaboration between human and animal health sectors for improved health security". WHO*

continuity plans, and the resilience of global value chains. In particular, the G20 should:

2.2.1 Reinforce WHO authority as the central coordination body against pandemics, agree on common standards and support countries with healthcare shortages;

The G20 should reinforce WHO's global pivotal role in providing evidence-based guidelines on core components of Infection Prevention and Control (IPC) programs and practices, while supporting countries and healthcare facilities in implementing them at the public and private levels.

G20 countries should commit to transparency and sharing information to manage emergencies. They should also encourage the adoption of IPC requirements and standards by involving stakeholders, including regulatory bodies and allied organizations, national IPC professional bodies, academia, private companies, nongovernmental organizations, and civil society groups.

Moreover, G20 members should intervene promptly and cooperate with WHO to support countries experiencing shortages in resources and healthcare facilities (e.g., supporting the distribution of PPE, vaccines and treatments).

2.2.2 Strengthening disease-surveillance systems and sharing information practices, and rolling out advanced technology;

The G20 should promote the adoption of a global information-sharing and surveillance framework that outlines data requirements and surveillance strategies at the country level.

An effective interoperable health surveillance system is critical in identifying and assessing pandemic risks and, consequently, for taking informed risk management decisions. At the country level, the system will support the identification of public health response initiatives to respond to and manage the pandemic locally. At the global level, standardized and coordinated international information sharing will allow authorities to monitor and take coordinated actions for crisis management. Surveillance systems for the prevention, preparedness, and control of emerging and re-emerging infections, including antimicrobial resistance, need to be strengthened (see the Box "Antibiotic stewardship: The example of bedaquiline and drug-resistant tuberculosis" in the Annex). The G20 should collaborate with global surveillance systems, such as the WHO Global AMR Surveillance System; adapt and reinforce national systems where appropriate; and scale up surveillance capacities as needed. The G20 should strengthen surveillance capacities to rapidly identify, trace and monitor cases of infectious diseases and provide recommendations for local quarantining policy. Emerging innovative technologies for preparedness and control of endemic diseases need to be incorporated. New pathogen genomics tools will improve detection and prevention of zoonotic diseases before they jump to humans, improve outbreak management by rapidly identifying causative agents, and facilitate the design of diagnostics and preventive, therapeutic, and other countermeasures, while monitoring their effectiveness. Pathogen genomics can also help identify gaps in infection prevention and control measures, improve assessment of transmission dynamics, identify networks to aid in tracing potential contacts, assess the spatial and temporal distribution of the epidemic, and identify the reproduction rate (R0) and missing transmission chains, which are especially important early in the epidemic. A sustainable

[86] *"Minimum requirements for infection prevention and control programs", Nov. 18, 2019, WHO*

biobanking mechanism for the standardized collection, characterization, and archiving of specimens, and sharing these specimens is necessary to facilitate and accelerate diagnostic test development and evaluation for diseases of epidemic potential. Sustainable biobanking networks for diseases of epidemic potential would be needed nationally and globally.

Digital technologies for rapid reporting, contact tracing and data management and analysis support surveillance capacities (see also Policy Action 2.2.3). The information-sharing system should be powered by real-time data based on shared indicators on transmissibility, such as incidence rate, seriousness, including cumulative deaths and hospitalization ratios, and impact, such as the share of cases with acute manifestation. In setting up disease-surveillance systems, patient data must remain secure and private. Investments in technology and human capacity are required to guarantee the interoperability of systems and compliance with the global framework. Trustworthy data governance models for both primary and secondary use of data will be keys to sustainable, efficient and secure access to data to improve the delivery of care during pandemics, enhance public health planning and foster research and innovation to discover and develop new treatments and vaccines.Investments in digital infrastructure will be required to tap the full potential of advanced technologies that can improve health system performance and increase pandemic preparedness and flexibility (see the Box “Pharmaledger: A blockchain-based healthcare platform” in the Annex).

The G20 should also promote and improve computing capacity, modeling and analytic tools for strategic planning in preventive and remedial measures. Data-sharing is a key to exploiting the opportunities of increased data availability while ensuring data privacy. The efforts must be focused on the quality and reliability of data and other inputs to ensure that analytical models are efficient and accurate. Analytical models and tools such as heat maps can manage a large number of variables to identify people exposed to infection. Mobility patterns, for example, can help experts understand the mechanisms of contagious disease transmission, so digital models will be valuable in managing emergencies. In particular, they could help decision makers identify the best preventive measures such as self-isolation and vaccination, and remedial measures such as clinical admission. The models could also be used to develop digital applications that would help prevent and monitor disease transmission.

Health data: The Finland example

Finland’s framework is a leading example of how to unlock the power of health data based on trust. This framework has four essential pillars:

• A national strategy on eHealth (2015), which boosts the digital transformation efforts taken by the country for two decades
• A legislative framework, the Act on Secondary Use of Health Data (2019), which enables the use of data for scientific research, innovation, education, knowledge management, while ensuring high data protection
• An interoperable infrastructure, Kanta (2010), that connects data sources through a common national structure for health information exchange
• A Health Data Permit Authority, FINDATA (2020), responsible for data permits and data requests, involving health data from the most important sources of the country.

This solid approach allows for trustworthy, efficient and secure access to data in research, development and innovation activities, education and knowledge management; it could be foundational for the European Health Data Space and inspire similar efforts in other countries across the globe.

2.2.3 Incentivize the adoption of e-Health solutions and telemedicine during infectious disease outbreaks;

The COVID-19 pandemic has exposed the lack of investment in and adoption of digital health solutions, leaving the potential of health data untapped and making health systems and organisations more vulnerable to crises.

The G20 should incentivize the use of e-Health solutions, such as contact tracing, warning apps and digital certificates, to enhance mitigation strategies and support public health management during pandemics. During the COVID-19 outbreak, South Korea's "always-on" disaster- and safety-information system used real-time data and risk information including localized geospatial information and credit card records, from existing disaster-management systems and government ministries[87]. It shared risk information directly through mobile notification alerts. Another example is Health Kit, a mobile app in China that traces contacts, record virological and serological test results and vaccines to monitor and manage the COVID-19 pandemic.

The G20 should support the adoption of telemedicine to ensure continuous health assistance and monitoring while preserving social distancing, including providing better technology to healthcare facilities and patients.

G20 members should cooperate to establish a trust framework on e-Health and telemedicine by promoting mutual recognition and interoperability and shared guidelines on telehealth modalities, including synchronous real-time telephone or live audio-video interaction, asynchronous "store and forward" technology, and remote patient monitoring. (For more on the strategic use of science, technology and data, see Recommendation 1 of the Policy Paper by the Health & Life Sciences Task Force).[88]

2.2.4 Support firms in the adoption of Business Continuity Plans (BCPs) and take preventive measures;

The G20 should help firms establish or revise business continuity strategies and plans in the wider context of pandemic planning, by capitalizing on lessons learned in health crises. Measures needed to slow the spread of the illness (e.g., reduced labor supplies and physical distancing) should be key inputs in addition to the determination of business priorities, critical assets and operations. Every business continuity plan should identify the human, material and financial resources that will be required in an emergency.

The COVID-19 pandemic has made it clear that all industries should develop reliable, deployable BCPs, particularly in digitizing business processes. Similarly, developing preparedness against emerging risks may help increase the insurability of pandemic risks. G20 should encourage national authorities to analyze local contexts and firms' efforts to maintain their businesses during the pandemic and adopt regulations and standards for business continuity plans to preserve economic value and human capital and to create new business opportunities. Government policies should provide an enabling environment for the private sector, particularly SMEs, which are more susceptible to the risks and more likely to lack the resources to create BCP tools. For instance, governments can provide financial support to help companies develop effective BCPs. Such incentives may include subsidies for companies to build remote-working capabilities or procure protective gear. Policymakers may consider tax reductions or refunds to businesses that establish or contribute to funds to

[87] *"Not the last pandemic: Investing now to reimagine public-health systems", McKinsey, May 21, 2021*
[88] *"Using Telehealth to Expand Access to Essential Health Services during the COVID-19 Pandemic", CDC, June 10, 2020*

prepare for a sudden loss of income in case of a pandemic, in addition to (re) insurance schemes.

The G20 should support the coordination of global BCPs across countries to preserve supply chains and the movement of persons essential for business and healthcare.

Occupational health physicians and company medical services should play key roles in defining and implementing BCPs, and in activating preventive and control measures. An innovative approach will be crucial in health systems governance. The public and private sectors can contribute to creating prevention programs, improving health care and monitoring specific conditions and chronic diseases. Company medical services should be linked to territorial assistance services to integrate health care provision, health promotion and welfare activities. Digitizing systems will enable more effective management of BCPs. Each BCP should specify the coordination and communication channels in local public and private health system networks, with a focus on sharing data and insights.

2.2.5 Reinforce the resilience of value chains by promoting the diversification of procurement and the conversion of production plants based on needs;

The G20 should promote the diversification of procurement, both private and public, to lower risks and make value chains more robust.

Public and private sectors have different levers to improve value chain resilience, starting with developing and assessing supply chain risks and mitigation strategies and promoting investments to increase resilience to different types of shocks. One of the lessons learned from COVID-19 has been that companies tend to focus on the shocks that occur most often, even though some less frequent shocks can inflict bigger losses[89]. G20 countries should incentivize supply chain risk management and end-to-end transparency: the first critical step entails a comprehensive view including detailed sub-tier mapping of the entire value chain to identify vulnerabilities. Regular and comprehensive stress-testing activity of the value chain should be performed at company and sector level. In addition, companies should develop an adequate governance structure with value chains risk indicators. The indicators should serve as an alarm system for risk and as triggers for mitigation plans.

G20 countries should also incentivize the conversion of production plants based on needs to support health goods production, including vaccines and PPE, at the country level; the G20 should beforehand support the innovation ecosystems essential to a quick conversion.

The G20 should also encourage open and resilient value chains with limited trade restrictions on essential goods, including pharmaceuticals, medical goods and vaccines, to better manage emergencies (for specifics see Recommendation 2 of the Trade and Investment Task Force). In addition, initiatives such as the "Global Value Chain Passport" on financial compliance could reinforce value chains, enhance transparency and strengthen inclusive and sustainable growth.[90]

[89] *"Risk, resilience, and rebalancing in global value chains", McKinsey, Aug, 6 2020*
[90] *"GVC Passport concept on Financial Compliance to Reinvigorate Firms' Growth Post-COVID-19", SME Finance Forum, Business at OECD and B20 Saudi Arabia, Sept. 11, 2020*

Policy Action 2.3: Scale up diagnostics, therapeutics and vaccines development and rollout, and adopt economic measures to speed a sustainable and inclusive recovery

G20 members should support the rapid scaling of diagnostic, therapeutic and vaccine production and equitable availability after infectious disease outbreaks, adopting clear guidelines and economic measures. The G20 should:

2.3. Expedite regulatory approvals for new diagnostics, therapeutics and vaccines, ensuring the application of shared quality and safety standards and guidelines;

The G20 should review the existing regulatory framework to guarantee timely and effective diagnostic, therapeutic and vaccine approval. This goal echoes the 100 Days Mission, presented at the G7 Heath Ministers' meeting in June 2021, that aims at reducing the time to develop and deploy diagnostics, therapeutics, and vaccines against future pandemics to 100 days. The WHO should play a central role, providing support to all stakeholders, including marketing authorization holders and national regulatory authorities, by defining standards and guidelines. Guidelines should suggest governance, procedures and requirements to maintain high quality and safety standards.

G20 countries should encourage frequent dialogue to coordinate industry leaders and public authorities, and create taskforces to coordinate the development, authorization and safety monitoring of vaccines and treatments during emergencies. Taskforces should foster cooperation with stakeholders and international organizations, facilitate clinical trials by providing scientific support, request and review scientific data, and provide feedback on vaccine and treatment development plans.[91]

2.3.2 Facilitate commercial and/or government partnerships to increase mass production of diagnostics, therapeutics and vaccines;

The G20 should facilitate commercial and/or government partnerships to secure the necessary supplies and support the scaling up of diagnostic, therapeutic and vaccine production, while strengthening cooperation among stakeholders including governments, international organizations, the private sector, from SMEs to large manufacturers, research institutes, and non-profits. The G20 should promote the development and funding of vaccine platform technology. Due to its intrinsic flexibility and scalability, platform technology will allow faster and cheaper vaccine development, regulatory approval and mass production. Indeed, platform technologies use "backbone" carriers or vectors that can be modified with antigens for each vaccine derived from the platform. Once a vaccine is developed and licensed, future development should be faster, requiring only the substitution of the antigen.[92]

The G20 should also promote investments in the development of a broad spectrum of anti-viral medicines. R&D should aim to develop small-molecule drugs that can stop viruses from spreading and replicating in the human body.[93] Anti-viral medicines play a key role between the emergence of a pandemic and the delivery of an effective vaccine. They could have several benefits including low costs and faster and easier distribution, since they do not require a cold chain.

[91] *"EMA's governance during COVID-19 pandemic", European Medicines Agency, Sept. 4, 2020*
[92] *"Concept paper for the development of a guideline on data requirements for vaccine platform technology master files", European Medicines Agency, Jan. 20, 2021*
[93] *"We Need to Start Investing in Antiviral Drugs for the Next Pandemic", Harvard Business Review, Feb. 1, 2021*

The WHO should strengthen its pivotal role in coordinating mass production of vaccines and treatments and provide comprehensive guidelines on strategy, scenario assessment, operations, and distributions for both the public and private sectors.[94]

Huo-Yan laboratories – Large-scale nucleic acid testing laboratories
When COVID-19 broke out in 2020, BGI Genomics created Huo-Yan laboratories, for testing and screening, combining automated nucleic acid extraction with high-throughput sequencing. The laboratories have been used in large-scale screening of suspected cases, assembling genome sequences, monitoring mutations and other critical efforts in the fight against COVID-19. Huo-Yan laboratories provided major technical support for the control of the pandemic by rapidly enhancing local capacity for nucleic acid testing. Set up in 13 major cities in China, they have become outposts of the international community's fight against COVID-19: daily testing exceeds 160,000 samples. So far, more than 80 Huo-Yan laboratories have been built in more than 30 countries and regions, from the United Arab Emirates, to Australia, the Philippines, Canada and Gabon, with total throughput of more than 435,000 samples per day.

Huo-Yan capabilities extend beyond rapid screening, and the laboratories can be built quickly, rapidly improving the local testing capacity. When the epidemic mitigates, they will play a critical role in large-scale population genetic testing such as in other infectious diseases and tumor detection, upgrading local medical and health systems, promoting the development of life science research and the health industry.

Huo-Yan laboratories bring advanced technologies and equipment to countries in need, and provide training and technical support to local laboratory staff. Using China's experience in COVID-19 prevention and control, many countries have quickly expanded their capabilities for nucleic acid testing of SARS-CoV-2 and other pathogens.

2.3.3 Support equitable global access to diagnostics, therapeutics and vaccines and invest in adequate transport and logistics infrastructure;

The G20 should support global initiatives to provide equitable and global access to diagnostics, therapeutics and vaccines at affordable prices, strengthen cooperation among stakeholders, and apply an effective vaccine management system to measure, monitor and evaluate vaccine-related performance, including availability, quality and cost[95]. G20 countries should pool resources and focus on groups and communities at a higher risk and countries with limited access to healthcare.

The G20 should recognize the relevance of transport and logistics in the fight against infectious diseases and invest in infrastructure and supply chain capacity (e.g., inventory capacity, cold-chain capacity, facilities and staff) to support the delivery of vaccines and treatments, especially in fragile settings, while increasing preparedness and flexibility.[96]

[94] *National Governors Association, 2020 – Preparing For The COVID-19 Vaccine And Considerations For Mass Distribution*
[95] *"COVID-19 Strategic Preparedness and Response Plan Operational Planning Guideline", WHO, 3 March 2021*
[96] *"Immunization supply chain and logistics—A neglected but essential system for national immunization programmes", WHO, March 2014*

COVAX - COVID-19 Vaccine Global Access

COVAX is the vaccines pillar of access to COVID-19 Tools (ACT) Accelerator, a partnership launched by WHO, academia, private sector and government, "supported the fastest, most coordinated, and successful global effort in history to develop tools to fight a disease.[97]" With some of the world's strongest partnerships, including CEPI, GAVI – The Vaccine Alliance, UNICEF and WHO, COVAX aims to accelerate the development of COVID-19 vaccines and guarantee fair and equitable access for every country in the world.

COVAX has developed two initiatives in parallel: COVAX Facility and COVAX AMC. COVAX Facility, a global procurement mechanism, aims at selecting and investing in the most promising vaccine candidates and equitably distribute them among at-risk groups of all participating countries. COVAX AMC represents the financing instrument that supports the participation of 92 low-income economies in the COVAX Facility.

2.3.4 Promote public-private partnerships to enable financing and insurance activities for a fast and sustainable economic recovery.

The COVID-19 pandemic has shown that a key policy challenge is to prevent widespread insolvencies and avoid excessive leverage across firms. Complexities have arisen in identifying the prevalence of non-viable firms, as locking in resources in less productive firms would slow the pace of a sustainable economic recovery. A balance must be found between the risk of supporting firms that may not be viable firms and prematurely liquidating productive firms.

It is therefore critical in the recovery phase to ensure that private finance supports long-term economic recovery and addresses risks of procyclicality. Access to private capital, including via capital markets, is necessary but needs to be facilitated and coordinated through a collaboration between the private sector and public institutions such as the IMF, MDBs, Paris Club, ECAs and large bilateral government lenders. These extraordinary efforts are essential in reestablishing capital market risk-taking, liquidity, price stability and market functionality.

To further leverage private finance, actions such as reprieves, standstills, forbearance, public sector guarantees, and more blended finance should be considered. Regulators and supervisors would need to remain flexible in terms of accounting, loan-loss management and capital buffers.

It is difficult to limit pandemic risks and make them insurable under traditional business models, leaving a protection gap that needs to be addressed. The insurance market could still play a role if stakeholders can create new models of shared responsibility between the private and the public sector, including public/private partnerships, as in the case of other catastrophic risks.

In fact, insurance mechanisms could benefit the whole private and public ecosystem from a risk-reduction perspective. First, by generating insights to identify risk drivers and mitigants through financial and risk management models; second, by creating incentives for governments and private sector leaders to take actions to reduce risk and thus premiums. Innovative solutions will be required, including public- and private-led parametric insurance funds with premiums[98] funded by donor nations. New partnerships between multilateral organizations and insurance companies could speed innovation

[97] "The Access to COVID-19 Tools (ACT) Accelerator", WHO
[98] "From Panic and Neglect to Investing in Health Security: Financing Pandemic Preparedness at a National Level", International Working Group on Financing Preparedness in collaboration with World Bank and Wellcome Trust

to manage pandemic risks, following the example of IDF, a public-private partnership led by the insurance industry, that since 2015 aims to better manage the risks of extreme events and climate.

Recommendation 3 – Reinforce critical information infrastructure and data security against major cyber incidents

The G20 should strengthen its efforts to develop more resilient and sustainable critical information infrastructure and data security, and clear approaches to crisis management and recovery, to protect digital access and cross-border data flows, especially during and after major cyber incidents.

Policy Actions

3.1 Improve global coordination to strengthen cybersecurity
G20 members should promote global coordination to improve the security and resilience of critical information infrastructure and data, developing a shared risk-based framework rooted on existing global standards, promoting the adoption of security and privacy-by-design principles, and enhancing cyber defense resources and capacity for both single organizations and supply chain networks.

3.2 Facilitate data- and intelligence-sharing during major cyber incidents
G20 members should promote a shared cyber incident response plan, encourage global information-sharing practices, and address the interoperability of cross-border data flows during major cyber incidents while protecting data privacy and security.

3.3 Implement post-breakdown recovery plans
G20 members should build public-private relationships to design and implement a robust and resilient joint post-emergency recovery plan for major cyber incidents, and ensure stable and secure network operations and data management at all times.

Leading Monitoring KPI	Baseline	Target
Global Cybersecurity Index, Median[99] (0-1 scale)	0.44 (2018)	0.60-0.65[100] (2030)

Source: *International Telecommunication Union (ITU)*
Owner: *G20*

SDGs Impacted

Recommendation 3 contributes to **SDGs 8, 9 and 17** by suggesting policy actions to boost technological upgrades and consolidate digital infrastructure, leveraging international cooperation:

Focus is on target 8.2, defending economic productivity through renewed attention to cybersecurity and data protection, and boosting resiliency against infrastructure breakdowns.

[99] *Based on a methodology that can be subject to potential revision over time; see the Annex for more details*
[100] *Depending on Index availability for 2030*

Actions are aimed at supporting target 9.b and 9.c, advocating international coordination for technological development around the world, including in developing countries, contributing to the universal and affordable digital access.

Global cooperation is a key to achieving targets 17.6 and 17.8, thanks to the definition of international frameworks for information, capabilities and best-practice-sharing.

3Ps Impacted

Recommendation 3 is in line with two principles of the G20 Italian Presidency: **People and Prosperity**

Context

In the 21st century, information infrastructure and data security have evolved from primarily technical domains to topics of global strategic importance. As noted, technological and cyber risks now rank among the global risks with the highest likelihood of coming to fruition and severity. While there is no universally accepted definition of "cybersecurity," one widely used definition of information security is "the preservation of confidentiality, integrity and availability of information." ENISA provides an alternative interpretation, by defining cybersecurity as "security of cyberspace, where cyberspace itself refers to the set of links and relationships between objects that are accessible through a generalized telecommunications network, and to the set of objects themselves where they present interfaces allowing their remote control, remote access to data, or their participation in control actions within that Cyberspace."[103] In this sense, cybersecurity can be defined as the practice of protecting physical infrastructure, networks, systems, programs, devices and data from any potential loss or harm.

In this chapter, the Action Council on Sustainability & Global Emergencies focuses on the concept of major cyber incident. An incident can be considered major when the disruption is too extensive for a single country to handle on its own or when it affects several countries, with such wide-ranging technical or political impacts that it requires timely coordination and response at global level.[104]

Major cyber incidents are thus characterized by their global scale, which can be more easily reached nowadays given the continuing consolidation of a digital marketplace that spans national and cultural boundaries. Their magnitude can generate severe damage, direct or indirect, beyond network and information systems, including democracy, society, health and the economy. They can be caused by cyberattacks, unintentional human error or other human actions, or by external events such as earthquakes or hurricanes.

The number of cyber incidents worldwide is growing quickly. Significant cyber incidents almost quadrupled from 2015 to 2020[105] and despite ongoing efforts to combat cybersecurity, the cost of cybercrime may reach $6 trillion annually in 2021[106]. Incidents can also be aggravated by more frequent natural disasters due to climate change, which increased by approximately 50% in the last 18 years compared to the previous period[107], causing damages to network infrastructures.

[103] *"Definition of Cybersecurity: Gaps and overlaps in standardisation", European Union Agency for Cybersecurity, July 1, 2016*
[104] *See for example the identification of cyber incidents as a crisis at the EU level: "Commission recommendation on coordinated response to large-scale cybersecurity incidents and crises"*
[105] *"Significant Cyber Events", CSIS, 2021*
[106] *"Cybercrime to Cost the World $10.5 Trillion Annually by 2025", Cybersecurity Ventures, 2019*
[107] *Oxford University, McKinsey Analysis*

Recent major cyber incidents include:
• In March 2021, a European cloud service company's datacenter was destroyed by a fire, affecting 3.6 million websites belonging to public authorities, banks and other commercial players, mostly in Europe[108];
• In 2021, a thankfully averted cyberattack on a US water plant could have caused an increase in the concentration of sodium hydroxide—also known as lye or caustic soda—making the water potentially dangerous for use;
• In 2020, more than a thousand customers, including several US government agencies, were victims of cyberattacks through a widely used third-party cloud-based network management software, compromising the confidentiality and integrity of vital data and systems;
• In 2020, two submarine cables in the Mediterranean Sea suffered major damage, causing internet disruptions and slowdowns for users in the Middle East and Africa;
• In 2019, cyber attackers stole administrative and operational data from an Indian nuclear power plant;
• In a hurricane in 2017, Puerto Rico's internet network and telecom infrastructure collapsed, with prolonged effects on island and the neighboring countries it served, including Brazil;
• In 2017, cyber attackers stole personal information, including the social security numbers, addresses and credit card numbers of more than 143 million consumers, from one of the largest US consumer credit reporting agencies[109];
• In 2017, "WannaCry" ransomware infected more than 200,000 computers worldwide, with critical impacts on sensitive facilities, including hospitals and financial institutions[110];
• In 2015, malicious actors broke into several Ukrainian electricity distribution companies remotely and took control of their systems, opening breakers at some 30 substations.

The risks associated with cyberattacks and incidents have continued to rise over the last decade. The number of devices and connections in general continues to grow, increasing the threat surface[111]. In particular, the continued convergence of IT and OT infrastructure and the acceleration of industrial IoT in critical infrastructure is increasing the potential destructive impact of incidents in sectors that are crucial for the functioning of our economy and society. While there are also security benefits associated with the concentration of network and data infrastructure in a small number of hyperscalers, such as the ability to achieve the optimal scale to meet system demand, that concentration arguably increases the potential impact of incidents that strike one or more of them. Moreover, attacks and the actors behind them continue to grow not only in number but also in diversity and sophistication. The growing complexity and digitalization of supply chain networks are raising the risk of third-party attacks, as well as the need for new supply chain security solutions.

Powerful trends are unfolding
Several trends are increasing the need for cybersecurity, including:

• Growing internet penetration around the world, across all countries;
• Increasing dependence on cloud storage;
• The growing number of interconnected devices, enabled by the proliferation of new technologies such as, IoT, and digital infrastructures such as 5G.

Internet penetration has grown significantly in the past decade. About 4.1 bil-

[108] "Millions of websites offline after fire at French cloud services firm", The Straits Times, 2021
[109] "Massive Equifax data breach hits 143 million", BBC, 2017
[110] "Randsomware cyber-attack: Who was been hardest hit?", BBC, 2017
[111] The cyber threat surface "refers to all the available endpoints that a threat actor may attempt to exploit in Internet-connected devices within the cyber threat environment," according to the Canadian Centre for Cybersecurity

lion people are online today, and the number of worldwide users was rising by an average of 7.5% per year (Fig. 8), even before Covid-19 struck and forced tens of millions to work and study from home. Efforts to recover from the pandemic have also triggered a multitude of innovations in work collaboration, distribution and service delivery, shifting multiple customer behaviors, habits and expectations.

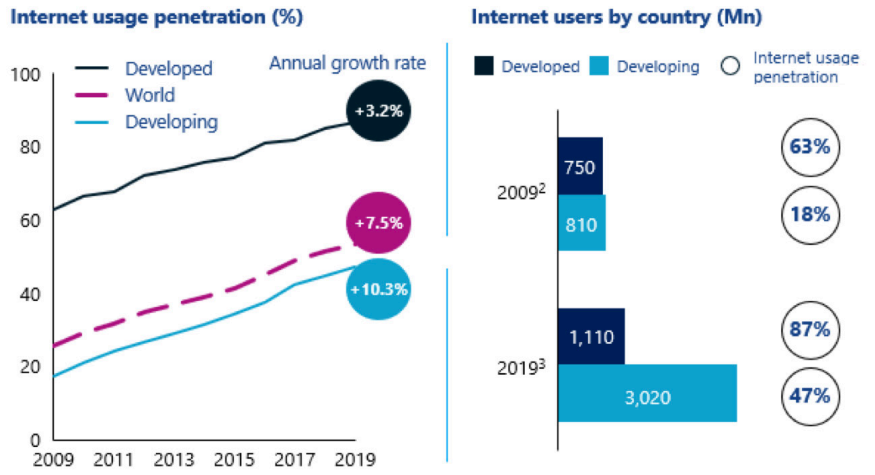


Figure 8: Internet user penetration growth and total internet users 2009-2019, ITU (2020)

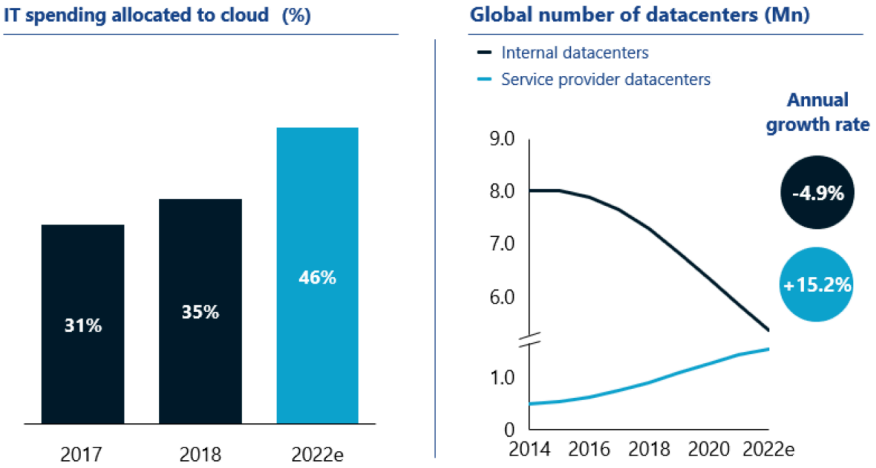


Figure 9: IT spending on cloud and total number of datacenters (IDC)

Rising volumes of data have boosted demand for cloud storage and digital services—by 2022, 28% of the spending of key IT companies may be allocated to the cloud[112]. The current trend is to outsource servers and data center storage (Fig. 9), especially to hyperscale public cloud providers, meaning that fewer players are likely to manage ever-larger amounts of data.

The number of IoT-connected devices worldwide has risen dramatically, and experts project that the number of connected devices will rise to 43 billion by 2023, an almost threefold increase from 2018. Meanwhile, the share of businesses that use IoT technologies has grown from 13 percent in 2014 to about 25 percent today. Indeed, IoT technologies have already given rise to landmark applications in sectors as diverse as Industry 4.0[113], smart cities and homes, connected cars and e-Health, also thanks to the increased availability and cost-effectiveness of the solutions.[114]

[112] *"Gartner Says 28 Percent of Spending in Key IT Segments Will Shift to the Cloud by 2022", Gartner, 2018*
[113] *Industry 4.0 commonly refers to the automation of manufacturing and industrial processes and practices*
[114] *"Growing opportunities in the Internet of Things", McKinsey, July 22, 2019*

The Action Council approach

Cyber incidents can affect everyone, from individuals to public institutions, corporations and critical infrastructure. In Recommendation 3, we ask the G20 to reinforce its commitment to boosting cyber resiliency and reducing capacity gaps. A shared approach to cyber crisis management and global frameworks are urgently needed to protect information infrastructure, data security and reliability. An effective response to global cyber incidents requires coordination among all relevant stakeholders and joint actions supported by each stakeholder's capabilities and resources.[115]

The Action Council on Sustainability & Global Emergencies believes that cyber incidents should be addressed through security policies with three key characteristics:

- **Global.** Given interdependencies across systems and sectors, global problems need to be tackled with global solutions—which is why global forums like the G20 are so important;
- **Risk-based.** Security comes at a cost, not just financial but often in functionality, that must be balanced against the risks. An analytical risk-based approach should help stakeholders identify, prioritize, deliver and manage security and privacy controls in line with their risk;[116]
- **Responsive.** As the threat landscape is always evolving, so too must our defenses. While Governments and organizations should adopt risk-based procedures, they should not set specific controls or technologies in stone.

Policy Action 3.1: Improve global coordination to strengthen cybersecurity

G20 members should promote global coordination to improve the security and resilience of critical information infrastructure and data, developing a shared risk-based framework rooted on existing global standards, promoting the adoption of security and privacy-by-design principles, and enhancing cyber defense resources and capacity for both single organizations and supply chain networks. The G20 should:

3.1.1 Promote the development of a global risk-based framework based on existing international standards and principles to foster a predictable regulatory environment and provide public institutions and private companies, including SMEs, with a state-of-the-art information security scheme;

The G20 should foster coordination on promotion and adoption of global cyber standards and policies, with the aim of building cybersecurity inclusivity at a global scale. Governments and organizations need to define and implement a global risk-based cybersecurity framework to increase trust and security in ICT products and services and move towards a de facto single global digital market[117]. The framework will allow stakeholders to build flexible but standardized reference schemes, based on risk-weighted industry characteristics, with a set of minimum rules, technical requirements, standards and procedures to preserve the general public's interests and boost global cyber resilience.

An holistic cyber risk approach will take into consideration several company characteristics, including critical assets (i.e., people, infrastructure, applications), controls, processes, organization and governance and more broadly all of its supply chain[118]. This requires a strategic dialogue with upstream and downstream partners to identify critical risks along the supply chain and pro-

[115] *"Commission recommendation on coordinated response to large-scale cybersecurity incidents and crises", Sept. 13, 2019*
[116] *"The risk-based approach to cybersecurity", McKinsey, Oct. 8, 2019*
[117] *"Future Series: Cybersecurity emerging technology and systemic risk 2020", WEF, Nov. 16, 2020*
[118] *"Perspectives on transforming cybersecurity", McKinsey, March, 2019*

mote the adoption of shared standards to increase systemic resilience.

In such a risk-based framework, security standards should be adopted in the private and public sectors as appropriate to the intrinsic risk of companies depending on the size, sector and services or products offered. Organizations handling critical information infrastructure and/or data, for example, will have to comply with more comprehensive standards, while minimum requirements, such as application of cyber hygiene principles, will be applied in other cases, such as for companies in non-critical sectors, particularly SMEs. The framework should include sector-agnostic and sector-specific principles. International institutions, national cybersecurity agencies, standardization bodies and private-sector technical experts (especially from technology and security vendors and critical sectors, such as telecommunication and health) should work together to develop the framework, building on international standards and frameworks already in place, such as ISO/IEC 27000 series, SOC 2, NIST Cybersecurity Framework and IEC62443.[119]

3.1.2 Address weaknesses in supply chain security by fostering security-by-design and privacy-by-design (or by-default), encouraging the adoption of secure and standardized principles in software development life cycles and sharing best practices on risk assessment of supply chains in critical sectors;

The G20 should encourage the adoption of existing global cybersecurity practices and standards, such as ISO 27034, in the software development lifecycle (i.e., SDLC) to protect data, intellectual property, transactions and user trust. As highlighted in policy action 3.1.1, a wider adoption of security-by-design and privacy-by-design standards along the supply chain would boost resilience.

Overall product security should be defined in terms of both security-by-design and privacy-by-design. Security should be incorporated into every step of the product development process to minimize system vulnerabilities, especially in IoT products,[120] and to increase product resilience and trustworthiness. Security requirements will need to evolve based on the threat landscape.
Recent attacks on third-party providers have spurred policymakers and industry leaders to think more carefully about supply chain security. With support and input from private sector and academia, governments and cyber authorities should share best practices in assessing risk in critical supply chains to identify weaknesses and protect against threats

3.1.3 Incentivize private and public investments in cybersecurity and in resilient and secure network infrastructures, to help private and public sector organizations, especially SMEs and those operating in critical sectors, enhance cyber defense resources and capacity, including a skilled workforce, security procedures and technological infrastructure;

The G20 should promote investments in capacity-building to increase systemic cyber resilience. Governments should incentivize, also with fiscal stimuli, private and public investments to fuel cyber defense initiatives and projects at international, country and individual levels.

At the international level, stakeholders should invest collectively in global projects and information infrastructure to avoid duplicating efforts and

[119] *"Shaping a New Global Architecture in the Age of the Fourth Industrial Revolution", WEF, April 2019*
[120] *"Incentivizing Responsible and Secure Innovation", WEF, June 2020*

maximize the value of stakeholders' expertise, such as in the IMF, UNODC, Global Forum on Cyber Expertise and Carnegie Endowment for International Peace (see the Box "Carnegie Endowment for International Peace (CEIP): FinCyber Project" in the Annex). For example, The G20 should strengthen their involvement in public-private initiatives aimed at promoting cyber terrorism (re)insurance pools, such as the International Forum of Terrorism Risk (Re)Insurance Pools (IFTRIP).

At the country level, public institutions should foster cybersecurity ecosystems for research and innovation where government, private sector and academia collaborate,[121] along the lines of initiatives such as Cyber NYC, CyberSpark in Israel and Cyber Campus France.

At the individual level, governments and private organizations should collaborate on educational and training campaigns to address cyber skills shortages.[122] Examples include the EU Digital Skills and Jobs Coalition[123] and ENISA Cybersecurity Higher Education Database[124]. The G20 should build education programs to foster cybersecurity skills and training programs to cover cybersecurity employability needs on a global scale. The G20 should also increase cybersecurity awareness, such as of social engineering, among citizens and the private and public sectors through education and communication programs. Kuratorium Sicheres Österreich in Austria is one example of a public-private awareness initiative.

The G20 can improve resilience and preparedness against cyber incidents by incentivizing investments in cyber defence resources and capacity and in risk-oriented governance structures, especially in SMEs and critical sectors. For example, public and private healthcare systems, including network facilities and medical services, should be reinforced against cyber incidents to prevent leakages in patient data, medical innovation and more broadly in healthcare operating systems.

Cyber NYC

Cyber NYC, a $100-million public-private partnership launched in 2018 by the New York City Economic Development Corporation (NYCEDC), is funded by the City of New York, Jerusalem Venture Partners and Sosa, a corporate innovation specialist. Its objective is to identify "strategic investments to grow New York City's cybersecurity workforce, help companies drive innovation and business development, and build networks and cyber community spaces.[125]"

The initiative stands on three main pillars:
• Develop the cyber workforce of tomorrow by creating 10,000 good jobs. Cyber NYC has partnered with industry and academia to support undergraduate and master degree programs, bootcamps and training;
• Make NYC a global leader in cybersecurity. Cyber NYC promotes frequent dialogues among corporate, investors, startups, governments, and global cyber stakeholders;
• Catalyze the next billion-dollar company. Cyber NYC supports start-ups and ideas with acceleration programs and start-up challenges.

[121] "Shaping a New Global Architecture in the Age of the Fourth Industrial Revolution", WEF, April 2019
[122] For more information on how educational strategies can address the gap in digital skills, see Recommendation 4 of the Digital Transformation Task Force
[123] "Digital skills and jobs coalition, European Commission
[124] "Cybersecurity skills development in the EU", ENISA
[125] CyberNYC

3.1.4 Promote regular public-private dialogue, such as forums and cross-country projects, to share best practices, seek a common understanding on norms of behavior in cyberspace, and stimulate research into cyber incident prevention and technological advances;

The G20 should promote initiatives to facilitate strategic dialogue and interactions across a global network of public institutions, organizations, agencies, academics and technical experts, such as the World Economic Forum Centre for Cybersecurity Platform. The initiatives should pursue a shared public-private commitment to raise systemic awareness, prevent cyber incidents and promote technological enhancements. The main stakeholders should commit to long-term strategic alignment and concrete operational cooperative efforts, based on the principles of cooperation, trust and shared challenges.

Forums that address norms of behavior include government groups such as the UN GGE and OEWG, public-private initiatives, such as the Paris Call for Trust and Security in Cybersecurity, and private-led programs such as the Cybersecurity Tech Accord.

One example of a shared public-private effort is the World Economic Forum's Partnership against Cybercrime, launched in 2020 with three main levels: a global partnership, "bringing international stakeholders together to provide an overarching narrative and commitment to cooperate"; Permanent Nodes, "a global network of organizations that strive to facilitate public-private cooperation," and Threat Focus Cells, "short-term, mission-driven groups of partners who engage in concrete, operational, cooperative efforts" maintained directly by the Permanent Nodes. [126]

In addition, the G20 should promote a shared effort to define a strategic research and innovation agenda in cybersecurity to address cross-country challenges and enable research programs.

Policy Action 3.2: Facilitate data- and intelligence-sharing during major cyber incidents

G20 members should promote a shared cyber incident response plan, encourage global information-sharing practices, and address the interoperability of cross-border data flows during major cyber incidents while protecting data privacy and security. The G20 should:

3.2.1 Develop a blueprint for cyber crisis management, including cyber incident response and business continuity plans, reinforcing coordination at the public and private levels.

The G20 should develop a blueprint for cyber crisis management that defines guidelines, key objectives, procedures and actors involved. The blueprint should complement existing national and regional plans and offer a shared approach and language for global incidents, including how to assess damages directly involving information infrastructure and data security, and business continuity plans including how to assess direct and indirect systemic damages and implications. The blueprint should also address cross-border data flows to guarantee secure transfer and access to relevant data before and during emergencies.

[126] *"Partnership against Cybercrime – Insight report", WEF, Nov. 16, 2020*

The G20 should promote cross-border coordination to facilitate the development of a shared and actionable cyber crisis management plan, addressing all relevant strategic, operational and technical aspects.

Jack Voltaic – Cyber research projects
Jack Voltaics are multi-sector, public-private cyber initiatives launched in 2016 in the US by the Army Cyber Institute (ACI) in conjunction with the private sector and major cities. Jack Voltaics include local government and industry experiments and exercises that examine a city's ability to prepare for, prevent and respond to a multi-sector cyber-attack, with a focus on response coordination and information-sharing practices.[127]

So far, ACI has promoted four initiatives:

• Jack Voltaic 1.0 is a framework to prepare for, prevent and respond to multi-sector cyberattacks on major cities;
• Jack Voltaic 2.0 is a research project that identified a bottom-up approach to developing critical infrastructure resilience;
• Jack Voltaic 2.5 is cyber workshop series to engage departments of defense (DoDs), critical infrastructure owners and municipal leaders on the relationships between commercial critical infrastructure and DoD critical missions, with the overarching goal of strengthening cyber resiliency;
• Jack Voltaic 3.0 is a regional exercise that tests cities' cyber response capabilities and coordination against physical and cyber threats, ensuring public services and safeguarding critical infrastructure.

3.2.2 Encourage the adoption of a global "cyber information-sharing as a platform" framework to share incident-related data for investigation, defense and management, protecting data privacy and security;

The G20 should encourage global cooperation and coordination at the private and public levels to detect and investigate cyber incidents and take action and share data and best practices in accordance with relevant domestic legal frameworks. A real-time, transparent and shared framework will be a key to collective situational awareness.[128]

A global information-sharing framework should bring together governments, corporates and educational organizations to detect and address cyber incidents. The framework should be based on three key data dimensions: strategic, operational and technical. The sharing framework should reference and build on international capabilities, leveraging sector-specific public-private centers such as ISACs (see the Box "Information Sharing and Analysis Centers (ISACs)" in the Annex), CiviCert and FIRST, and private alliances and consortiums, such as the Cyber Threat Alliance, to improve the security of the digital environment.[129]

3.2.3 Address cross-border data flows to guarantee secure transfer and access to relevant data before and during emergencies;

The G20 should promote the adoption of measures that facilitate information-sharing and data flow across countries during emergencies. The G20 should encourage the adoption of comprehensive and interoperable data

[127] *Army Cyber Institute*
[128] *"Cybersecurity Leadership Principles - Lessons learnt during the COVID-19 pandemic to prepare for the new normal", WEF, May 2020*
[129] *"Shaping a New Global Architecture in the Age of the Fourth Industrial Revolution", WEF, April 2019*

protection legislation that allows free, secure movement of data between jurisdictions, respecting the rights of individuals and anchored to the core principles of transparency, fairness and accountability.

During the WEF's annual meeting 2019 in Davos-Klosters, the Japanese Prime Minister introduced the concept of "data free flow with trust," in which trust and openness of data flows coexist and complement each other.[130] For a more detailed analysis of the concept of data free flows with trust, see Recommendation 2 of the Policy Paper of the Digital Transformation Task Force.

Policy Action 3.3: Implement post-breakdown recovery plans

G20 members should build public-private relationships to design and implement a robust and resilient joint post-emergency recovery plan for major cyber incidents, and ensure stable and secure network operations and data management at all times. The G20 should:

3.3.1 Promote collaborative public-private partnerships among governments, insurers, cybersecurity organizations and academia for market-oriented recovery plan development, including IT infrastructure recovery services and cyber resilience services;

The G20 should incentivize public-private partnerships to support the implementation and enablement of recovery plans. Each recovery plan should span cybersecurity-related activity with the aim of protecting critical information infrastructure and data security and promptly restoring damaged systems. The G20 should promote activities to rapidly and effectively manage responses and recovery planning, leveraging expertise and know-how of all relevant stakeholders that could play an active role in the cyber risk management and recovery phase. "Cyber Storm," an annual exercise promoted by the US Cybersecurity & Infrastructure Security Agency, simulates the discovery of and response to a large-scale, coordinated cyberattack. The exercise helps test cybersecurity preparedness and identify effective response processes, procedures and information-sharing practices. ENISA is responsible for a parallel programme of pan-European cyber exercises called Cyber Europe.[132]

3.3.2 Promote innovative, adaptive financing and insurance solutions for all stakeholders, including investments to rebuild damaged physical or information assets using shared cybersecurity standards;

The G20 should offer incentives for the adoption of financing and insurance mechanisms to support affected organizations, firms, especially SMEs, and every other actor in the value chain. The aim should be to develop innovative solutions to support parties affected by cyber incidents and reduce the burden of responses on companies' budgets, including through insurance solutions.[133] The incentives should aim to rebuild damaged physical or information assets and include control mechanisms, such as incentives fragmentation, to ensure the application of shared cybersecurity principles, such as security-by-design and privacy-by-design, and standards (see policy action 3.1.1 for an in-depth discussion).

The cyber (re)insurance market has been growing, but some factors have limited its spread and adoption in the public and private sectors: the limited availability of historical data, the changing nature of cyber risk and the lack of

[130] *"Data Free Flow with Trust (DFFT): Paths towards Free and Trusted Data Flows", WEF, May 2020*
[131] *CISA*
[132] *"EISA manages the programme of pan-European exercises," EU Agency for Cybersecurity (ENISA)"*
[133] *"Disaster Risk Financing - A global survey of practices and challenges" OECD, 2015*
[134] *"Enhancing the Role of Insurance in Cyber Risk Management", OECD, 2017*

access to corporate security information.[134] The business model is still emerging, but part of the answer may be a joint go-to-market approach with cyber companies that have the skills, intel, technology and insights to calculate risk based on real-time data.

There is growing concern that insurance companies or the private sector will not be able to manage the financial impact of cyber incidents on their own, with the potential of significant accumulation losses. The cost of major cyber incidents can be extreme. The 2017 NotPetya "wiper" malware attack, for example, affected thousands of organizations with total damages of about $10 billion.[135] G20 countries will need to promote initiatives to manage cyber accumulation risk, such as risk pooling, which can enhance private market capacity, limiting each company's exposure and benefiting from risk diversification. The first commercial cyber risk pool was launched in Singapore in 2018, backed by traditional reinsurance and insurance-linked securities, with a commitment up to $1 billion.

3.3.3 Foster cyber incident post-mortem analysis through dedicated public-private taskforces, based on a shared blueprint for cyber crisis management.

The G20 should promote post-mortem cyber incident assessments, including identifying and limiting breaches of other critical infrastructure and data security. Governments, private companies and academia should pool resources to promote coordinated researches and actions.

[135] *"How the Worst Cyberattack in History Hit American Hospitals", Slate, Nov. 5, 2019*

Annex

Examples / Initiatives

Oil and Gas Climate Initiative CCUS KickStarter

The CCUS KickStarter initiative was launched by the Oil and Gas Climate Initiative (OGCI) in 2019 to facilitate large-scale commercial investment in CCUS.

It aims to enable multiple low-carbon industrial hubs. These hubs will capture carbon dioxide from several industrial sources within one region and bring economies of scale by sharing transport and storage infrastructure. The final aim is to create the market conditions for CCUS to play a significant role in decarbonizing industry. This objective is achieved also engaging with national and local governments, industrial emitters and other investors, investing in anchor projects to enable hubs.

At the moment, OGCI selected eight hubs, of which four (Net Zero Teesside, UK; Northern Lights/Longship, Norway; Rotterdam, Netherlands; and China North-West) have a defined CCUS concept, while the remaining four are under evaluation.

ConectarAGRO

ConectarAGRO is a non-profit association that aims to guarantee in-field internet access to producers all over Brazil, as more than 70% of rural and remote properties in Brazil currently do not have access to the network. The association was established by CNH Industrial, in partnership with seven telecommunications companies (AGCO, Bayer, Jacto, Nokia, Solinftec, TIM and Trimble)

By 2020, the association was able to expand connectivity to more than 5.1 million hectares in rural areas, representing around 8% of the country's grain and sugarcane plantations. This achievement benefited more than 575,000 people, 50,000 farms, and 218 towns across 8 States.

Now, the goal is to further expand connectivity to an additional 13 million hectares of land by the end of 2021. As a result, ConectarAGRO will enable rural producers to fully benefit from today's precision farming, digital and automated technological resources, whilst gaining access to a full range of new products and services enabled by connectivity.

Cestas Biomethane Circular Economy

In Cestas, near Bordeaux, France, Pot au Pin Energie, Air Liquide and Carrefour have promoted a partnership with local companies operating in the energy, food and automotive industries, to establish a biomethane production unit and a multi-energy distribution station.

The production unit collects around 20,000 tons per year of intermediary and converts it into biogas through a biodigester. The biogas is upgraded to biomethane and then fed into the methane distribution network that supplies a station with the capacity to refuel up to 100 industrial vehicles per day, including buses and commercial vehicles. The biomethane-powered vehicles transport goods to local supermarkets, thus completing the methane value chain and offsetting almost all CO2 transport emissions.

This initiative is an example of how private partnerships, building on circular economy solutions, can establish sustainable value chains centered around local sites.

The Emergency Management Programme

The Emergency Management Programme (EMP) of Confindustria (the Confederation of Italian Industries) aims to promote prevention and risk management culture in SMEs and to support companies to face an emergency crisis.

This is an example of public-private partnership between Confindustria and the National Civil Protection Department, which is a structure of coordination under the direct responsibility of the Prime Minister. The partnership was formalized in 2016 with a MoU that matches the deep knowledge of a large numbers of companies all over Italy and specific sectoral skills with the contextualized control of the needs of the affected areas and the knowledge of preparedness techniques.

This EMP allows to boost a country's response to emergencies (earthquakes, floods, Covid-19, etc.) and, during "peacetime", to promote widespread awareness aimed at both SMEs and local administrations, training activities, company exercises to enhance preparedness and risk management skills, with a specific focus on georisks and anthropic risks, that constitutes the core business of civil protection.

EMP is also developing, with the Italian Ministry of Economic Development, an initiative to identify SMEs' risk awareness level, by collecting best practices and resilient business models and analyzing which strategies are adopted by SMEs to react to external shocks and to ensure their production continuity. The objective is also to identify policy recommendations on the subject.

LIFE DERRIS

LIFE DERRIS is a EU-funded initiative launched in 2015 by Unipol Group with the academic consortium CINEAS, the local governmental association Coordinamento Agende 21 Locali, the Municipality of Turin and the National Association of Italian Municipalities ANCI, with the objective of preventing and mitigating the risks posed by extreme weather events to SMEs.

This initiative aims to stimulate public-private coordination to strengthen SMEs' resilience in weather events by developing distinctive climate-related risk management capabilities, tools and financial instruments for adoption solutions.[136]

The project promotes the diffusion of risk prevention and management culture by organizing dedicated training sessions.

LIFE DERRIS is one example of an initiative to transfer climate-related risk management knowledge and expertise from insurers to SMEs and municipalities.

Task Force on Climate-related Financial Disclosures (TCFD)

In April 2015, the G20 Finance Ministers and Central Bank Governors (under Turkey's Presidency of the G20) asked the Financial Stability Board (FSB) to review how the financial sector can take account of climate-related issues. As part of its review, the FSB identifies the need for better information to support informed investment, lending, and insurance underwriting decisions and improve understanding and analysis of climate-related risks.

The TCFD was established by the FSB in December 2015 to develop a set of voluntary, consistent disclosure recommendations for use by companies in providing information to investors, lenders and insurance underwriters about their climate-related financial risks.

[136] *"Collaborating for resilience – Partnerships that build disaster-resilient communities and economies", UN Environment Programme Finance Initiative, 2015*

The FSB selected an initial group of 29 representatives across banks, insurers, asset managers, pension funds, credit rating agencies and non-financial companies. In February 2020, TCFD had amassed over 1,000 supporters.

The United Kingdom is the first country to announce that TCFD-aligned disclosures will be mandatory across the economy by 2025. Adoption around the world remains nascent, however.

While the TCFD addresses reporting standardization, the quality of reporting remains as good as the data provided as inputs. Accessing high quality data and methodologies for TCFD reporting remains a key issue for industry and governments to work out. The TCFD represents a worthwhile example of a private-sector led initiative in partnership with the G20 process.

The Coalition for Epidemic Preparedness Innovations (CEPI)

CEPI, a global partnership among public, private, philanthropic, and civil society organizations, aims to "accelerate the development of vaccines against emerging infectious diseases and enable equitable access to these vaccines during outbreaks." CEPI has identified critical gaps in vaccine funding and R&D implementation and has defined three main areas of intervention:

• CEPI will support vaccine proof-of-concept and safety testing and define investigational vaccine stockpiles against known threats.
• It will fund and promote platform technologies to accelerate the development and manufacture of vaccines against unknown and emerging infectious diseases and pathogens.
• It will coordinate activities to strengthen healthcare systems' capacity and advance product development regulatory science.

Antibiotic stewardship: The example of bedaquiline and drug-resistant tuberculosis

By 2050, antimicrobial resistance (AMR) infections could cause 10 million deaths annually—more deaths than are caused by cancer or diabetes today[137]. Drug-resistant tuberculosis (DR-TB), which shares a mode of transmission and symptoms with COVID-19, now accounts for one-third of all AMR-related deaths.[138]
It's clear that we need to take action now to protect antibiotics like those used to treat DR-TB, so that they can continue to protect us. Stewardship is crucial to ensure that antibiotics are used safely and correctly and, ultimately, to protect their long-term effectiveness.

In collaboration with multisectoral partners, Johnson & Johnson promotes the stewardship of bedaquiline, the first tuberculosis medicine with a new mechanism of action to be introduced in more than 40 years.[139] The company does this through continuing medical education activities and the dissemination of relevant resources to physicians who request information about the product. In addition, it has a rigorous pharmacovigilance framework in place to document global safety data related to bedaquiline, allowing identification of any emerging trends from ongoing use of bedaquiline in the field. The company also participated in antibiotic resistance surveillance programs for bedaquiline in collaboration with WHO-recognized reference laboratories and supports assay development of drug sensitivity testing in collaboration with external partners.

By working through the Stop TB Partnership's Global Drug Facility, a globally recognized procurement mechanism that facilitates worldwide, equitable access to tuberculosis medicines, the company continues to safeguard the supply security and ensure the quality of its medicine for multidrug-resistant tuberculosis.

[137] *"A call to action: It's time to end drug-resistant tuberculosis", The Economist Intelligence Unit; 2019*
[138] *Tuberculosis, Johnson & Johnson*
[139] *Ibid.*

Pharmaledger: A blockchain-based healthcare platform

Pharmaledger is a "36-month project that brings together 12 global pharmaceutical companies and 17 public and private entities, including technical, legal, regulatory, academia, research organizations and patient representative organizations," according to the website. The project is sponsored by the Innovative Medicines Initiative and the European Federation of Pharmaceutical Industries and Associations under the Horizon 2020 program.

Its objective is to develop a "widely trusted platform that supports the design and adoption of blockchain-enabled healthcare solutions while accelerating delivery of innovation that benefits the entire ecosystem, from manufacturers to patients." The platform will serve as a single source of truth and be validated through use cases in supply chain, clinical trials and health data.

In supply chain, Pharmaledger will address priorities for pharmaceutical manufacturers, distributors, dispensers, and governments, including patient safety, reliable product traceability, counterfeiting and fraud reduction, and compliance with regulations.

In clinical trials, it will speed clinical development and submissions by providing an end-to-end clinical trial solution that will guarantee transparency, auditability, traceability and fine-grain access control across all the processes.

In health data, it will pursue wide and global access to health data to guarantee timely and effective response measures, develop new medicines, and improve the safety, effectiveness and monitoring of clinical trials.

Carnegie Endowment for International Peace (CEIP): FinCyber Project

The FinCyber Project is an initiative promoted by CEIP, aimed at increasing financial system security against cyberattacks.

The project was born through the cooperation of more than 200 international stakeholders, including government organizations, financial regulators, companies and academics.[140]

The initiative promotes research, proposing actionable policies and updating public and private sector organizations on key developments.

The FinCyber Project has developed a tool box with material supporting cyber security capability building, dedicated, in particular, to low-income countries, less cyber-mature and smaller organizations.[141]

Information Sharing and Analysis Centers (ISACs)

Information Sharing and Analysis Centers are non-profit organizations "that provide a central resource for gathering information on cyber threats (in many cases to critical infrastructure) as well as allow two-way sharing of information between the private and the public sector."[142]

ISACs were introduced in 1998 in the US to protect critical infrastructure from cyber and physical security threats and other hazards. Their objective is to "help critical infrastructure owners and operators protect their facilities, personnel and customers from cyber and physical security threats and other hazards. ISACs collect, analyze and disseminate actionable threat information to their members and provide members with tools to mitigate risks and enhance resiliency."[143]

[140] Carnegie Endowment for International Peace
[140] "Cyber Resilience and Financial Organizations: A Capacity-building Tool Box", Carnegie Endowment for International Peace

There are 21 sector-dedicated ISACs including financial service, automotive, energy, aviation, communication and defense industrial base sectors. Most ISACs have 24/7 threat warning and incident reporting systems and records of responding to and sharing actionable and relevant information quickly.

A successful example is the Aviation ISAC, which facilitates collaboration across the aviation industry worldwide and builds resiliency against cyber threats. Its working groups address some of the most critical topics of the industry including network security architecture, product security, airport technology, compliance & third-party risk, threat actors and fraud. Aviation ISAC provides its members with strategic and correlation analysis to identify and assess potential cyber threats. "Information sharing occurs across multiple channels, including a secure threat intelligence platform where members have access to IOCs, APT data, campaign activity, mitigation strategies, reports, discussion forums, and more." [144]

[142] *Information Sharing and Analysis Centers (ISACs), ENISA, 2017*
[143] *National ISACs*
[144] *Aviation ISAC*

Monitoring KPIs

One of the objectives of the B20 Italy 2021 is to show up with concrete and practical policy recommendations. At this aim, we have worked to identify one KPI for each policy recommendation to allow the measurement of their success or implementation progress across countries.

An appropriate KPI should:
- Already exist
- Be monitored by international bodies
- Be specific and directly linked to the policy recommendation.

Thanks to a joint effort among the Coordination Group, the Chair, the Co-Chairs, the AC members and various experts, we have identified the most relevant KPIs for each Recommendation and then selected the three most appropriate, balancing pros and cons.

Recommendation 1

Environmental Performance Index
The Environmental Performance Index (EPI) is a metric aimed at measuring the environmental health and ecosystem vitality of ranked countries. In the latest version (2020), it was based on 32 indicators relative to 11 issue categories: air quality, sanitation and drinking water, heavy metals, waste management, biodiversity and habitat, ecosystem services, fisheries, climate change, pollution emissions, agriculture and water resources.

Key points in favour: Coverage of a broad spectrum of environmental themes treated in the Policy Paper; methodology built with the aim of achieving UN SDGs; wide global coverage

Responsible organizations: Yale Center for Environmental Law and Policy (YCELP), Yale University; Center for International Earth Science Information Network (CIESIN), Columbia University

Countries ranked in the latest version: 180 (2020)

EPI median in the latest version: 44 (2020), on a 0-100 scale

For more information, please visit the website of the Yale University.

Recommendation 2

Global Health Security Index
The Global Health Security (GHS) Index is a metric aimed at measuring health security and capabilities of ranked countries. In the latest version (2019), it was based on 34 indicators relative to 6 categories: prevention, detection and reporting, rapid response, health response, compliance with international norms and risk environment.

Key points in favour: Coverage of a broad spectrum of health-related themes treated in the Policy Paper; wide global coverage

Responsible organizations: Nuclear Threat Initiative (NTI) and the Johns Hopkins University Center for Health Security, with The Economist Intelligence Unit (EIU)

Countries ranked in the latest version: 195 (2019)

GHS Index median in the latest version: 37 (2019), on a 0-100 scale

For more information, please visit the website of the Global Health Security Index.

Recommendation 3

Global Cybersecurity Index
The Global Cybersecurity Index (GCI) Index is a metric aimed at measuring cybersecurity commitment of ranked countries. In the latest version (2018), it was based on 5 pillars: legal measures, technical measures, organizational measures, capacity development, and cooperation.

Key points in favour: Coverage of a broad spectrum of cybersecurity themes treated in the Policy Paper; wide global coverage

Responsible organizations: International Telecommunication Union (ITU)

Countries ranked in the latest version: 175 (2018)

GCI median in the latest version: 0.44 (2018), on a 0-1 scale

For more information, please visit the website of the International Telecommunication Union.

Methodology to estimate Monitoring KPIs target

2030 has been set as the target year in line with the 2030 UN Agenda for Sustainable Development (UN SDGs).

Expected countries median has been selected as metric to define the target. We assumed a positive impact of policy recommendations on countries environmental, health and cybersecurity performance; in particular, we expected a rapid convergence of many medium-ranked countries towards high scores in the next 10 years, resulting in the increase of the indices' median.

List of abbreviations

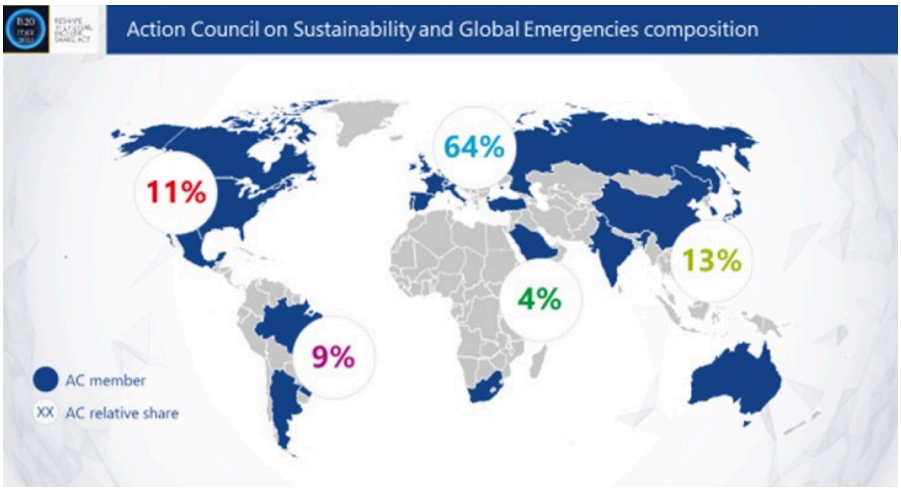
ACI	Army Cyber Institute
AI	Artificial Intelligence
ANCI	Associazione Nazionale Comuni Italiani
APT	Advanced Persistent Threat
BCP	Business Continuity Plan
CEPI	Coalition for Epidemic Preparedness Innovations
CISA	Cybersecurity and Infrastructure Security Agency
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Use and Storage
CDSB	Climate Disclosure Standard Board
CME	Chicago Mercantile Exchange
CO2	Carbon dioxide
COP	Conference of the Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
COVAX	COVID-19 Vaccines Global Access
CSIS	Center for Strategic and International Studies
CTCN	Climate Technology Centre and Network
DHC	District Heating and Cooling
DoD	Department of Defense
EC	European Commission
ECA	Export Credit Agencies
ECHA	European Chemicals Agency
ESG	Environmental, Social and Governance
EMA	European Medicines Agency
ENISA	European Network and Information Security Agency
EU	European Union
EU JESSICA	European Union Joint European Support for Sustainable Investment in City Areas
FAO	Food and Agriculture Organization
FIRST	Forum of Incident Response and Security Teams
GAVI	Global Alliance for Vaccines and Immunization
GIIF	Global Index Insurance Facility
GDP	Gross Domestic Product
ICMIF	International Cooperative and Mutual Insurance Federation
ICT	Information and Communications Technology
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IHR	International Health Regulations
ILO	International Labour Organization
IMF	International Monetary Fund
IOC	Indicator of Compromise
IoT	Internet of Things
IPC	Infection Prevention and Control
IPBS	International Partnership of Business Schools
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
ISAC	Information Sharing and Analysis Center
ISO	International Organization for Standardization
ISO/IEC	International Organization for Standardization / International Electrotechnical Commission
IT	Information Technology
ITU	International Telecommunication Union
IUNC	International Union for Conservation of Nature
KPI	Key Performance Indicator
MDB	Multilateral Development Bank
Nbs	Nature-based solutions
NCD	Non-Communicable Disease

NCS	Natural Climate Solutions
NDC	National Determined Contributions
N-GEO	Nature-based Global Emissions Offset
NGO	Non-Governmental Organization
NIST	National Institute of Standards and Technology
OECD	Organization for Economic Cooperation and Development
OGCI	Oil and Gas Climate Initiative
OIE	Office International des Epizooties
OT	Operational Technology
PPE	Personal Protective Equipment
PPP	Public-private partnership
PV	Photovoltaic System
R&D	Research and Development
RNA	Ribonucleic Acid
SARS	Severe Acute Respiratory Syndrome
SDG	Sustainable Development Goal
SME	Small and Medium-sized Enterprise
TCFD	Task Force on Climate-related Financial Disclosures
TEC	Technology Executive Committee
UN	United Nations
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UN GGE	United Nations Group of Governmental Experts on Developments
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UNODC	United Nations Office on Drugs and Crime
UN OEWG	United Nations Open-ended Working Group
UN REDD	United Nations Reducing Emissions from Deforestation and forest Degradation
VCMUS	Voluntary Carbon Market United States
WEFVCM	World Economic Forum Voluntary Carbon Market
WEF-IBCWEF	World Economic Forum International Business Council World Economic Forum
WHOWEF-IBC	World Health Organization - World Economic Forum International Business Council
WHO	World Health Organization

Schedule of Taskforce Exchanges

#	Date	Theme
1	February 26th , 2021	Task Force Member Call on first draft
2	March 26th, 2021	Task Force Member Call on second draft
3	April 30th, 2021	Task Force Member Call on third draft
4	June 4th, 2021	Task Force Member Call on fourth draft

World map with members by region



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