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International Science Council

Transformations within reach:
Pathways to a sustainable and resilient world

SYNTHESIS REPORT

First published in January 2021.

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Transformations within reach:
Pathways to a sustainable and resilient world

Synthesis Report

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Acknowledgments

This report is a synthesis of the four thematic reports produced as part of the IIASA–ISC Consultative Science Platform, "Bouncing Forward Sustainably: Pathways to a post-COVID World." The authors would like to acknowledge the rich discussions that took place and the insights provided by the chairs and participants in the 12 online thematic consultations that took place during 2020 as part of this Initiative. The consultations elicited the expert views of nearly 300 leading scientists, policy thinkers, and practitioners from around the world.

We are particularly grateful to the chairs of each thematic discussion track: Adebayo Olukoshi (Director for Africa and West Asia at the International Institute for Democracy and Electoral Assistance (International IDEA) for Governance; Lidia A. Brito (Director of UNESCO Regional Bureau for Sciences in Latin America and the Caribbean) for Science Systems; Hans Olav Ibrekk (Policy Director, Section for Energy and Climate, Norwegian Ministry of Foreign Affairs and Co-Facilitator, Technical Advisory Group, SDG 7) for Energy; and, Ismail Serageldin (Emeritus Librarian of Alexandria and Founding Director of the Bibliotheca Alexandrina) for Food – for their expert advice on the design of the consultations and the deft steering of the consultative proceedings.

We would like to thank all the Members of the Advisory Board of this Initiative for their purposeful engagement, clear guidance and constant encouragement. With HE Ban Ki-moon, former UN Secretary General as its Patron, the Advisory Board is chaired by HE Mary Robinson, Chair of The Elders, Patron of ISC, and former President of Ireland and includes Junaid Kamal Ahmad (Country Director for the World Bank in India, Peter Bakker (President and CEO of the World Business Council for Sustainable Development), Preety Bhandari (Director for Climate Change and Disaster Risk Management Division of the Sustainable Development and Climate Change Department at Asian Development Bank), Peter Gluckman (Director of the Koi Tū: the Centre for Informed Futures, University of Auckland; Chair of the International Network for Government Science Advice; President-Elect of the International Science Council; former Chief Science Advisor to the Prime Minister of New Zealand), Heide Hackman (Chief Executive Officer of the International Science Council), Naoko Ishii (Professor in University of Tokyo and Director for Global Commons), Jian Liu UNEP Chief Scientist and Director of the Science Division), Carlos Nobre (Senior Researcher at the Institute for Advanced Studies, University of Sao Paolo; Member of the Brazilian Academy of Sciences and former member of the Scientific Advisory Board of the UN Secretary-General), Daya Reddy (President of the International Science Council), Achim Steiner (Administrator of the United Nations Development Programme) and Albert van Jaarsveld (Director General and CEO of the International Institute for Applied Systems Analysis).

The Leadership team would also specifically like to thank Albert van Jaarsveld and Heide Hackman for their ready and unconditional support to this initiative. This, combined with the strong engagement of the Theme Leads of the four themes, enabled the Initiative to produce a set of five well-informed reports—four thematic reports and this Synthesis Report—in the short period of eight months.

Finally, we are most grateful to a number of IIASA and ISC staff for their hard work and support to this Initiative. We would particularly like to thank Anastasia Aldelina Lijadi, Executive Assistant to the DDGS at IIASA, for being a valuable member of the team and helping us hold the entire initiative together. We received strong communications support from the teams across the two Institutes led by Alison Meston at ISC and Iain Stewart at IIASA and supported by Pavel Kareem Hodorogea (IIASA), Zhenya Tsoy (ISC), Philippa Baumgartner (IIASA),

Ansa Heyl (IIASA), Adam Islaam (IIASA), Rachel Potter (IIASA), Bettina Greenwell (IIASA), Joe Undercoffer (IIASA) and Anne Thieme (ISC).

Synthesis Report

Introduction

> We envisage a world in which every country enjoys sustained, inclusive and sustainable economic growth and decent work for all. A world in which consumption and production patterns and use of all natural resources — from air to land, from rivers, lakes and aquifers to oceans and seas — are sustainable. One in which democracy, good governance and the rule of law, as well as an enabling environment at the national and international levels, are essential for sustainable development, including sustained and inclusive economic growth, social development, environmental protection and the eradication of poverty and hunger. One in which development and the application of technology are climate sensitive, respect biodiversity and are resilient. One in which humanity lives in harmony with nature and in which wildlife and other living species are protected
>
> (*Vision of Agenda 2030* [United Nations, 2015])

The UN High-level Political Forum on Sustainable Development (HLPF) recognized in its September 2019 declaration that the world is not on track to achieving the Sustainable Development Goals (SDGs). Since then, the COVID-19 pandemic has threatened to reverse the progress made on Sustainable Development Goal 3 (SDG 3), which aims to "ensure healthy lives and well-being for all at all ages." Due to COVID-19, nearly 70 countries have halted childhood vaccination programs, and in many places, health services for cancer screening, family planning, or non-COVID-19 infectious diseases have been interrupted or are being neglected. The pandemic is also jeopardizing the achievement of several other SDGs, while exacerbating poverty and slowing progress on eliminating energy poverty. According to the World Bank, an additional 88 to 115 million people will have lived in extreme poverty in 2020 because of COVID-19. Moreover, according to projections, COVID-19 will bring about the worst reversal in global poverty eradication in the last three decades (Lakner et al., 2020). There are also serious concerns that COVID-19 is exacerbating food inequalities (Gralak et al., 2020). The World Food Program has projected that, as a result of the impacts of COVID-19 on livelihoods and income, nearly 265 million people will have been pushed into acute food insecurity by the end of 2020 (Swinnen and McDermott, 2020). At the same time, without significant scaling up, efforts to ensure universal access to affordable, reliable, sustainable, and modern energy by 2030 will fall short (IEA et al., 2020). Populations without access to modern energy will be significantly more vulnerable to the present and future health crises (Brosemer et al., 2020) due to exposure to air pollution and poor access to health services.

Responding to the crisis, the World Bank (2020) has stated that countries will need to prepare for a different economy post-COVID-19, by allowing capital, labor, skills, and innovation to move into new businesses and sectors (World Economic Forum, 2020). In the first two months of the crisis, an unprecedented 12 trillion USD was set aside for recovery (Andrijevic et al., 2020) in the COVID-19 aftermath, with the intention being to kick-start growth and provide employment (Cassim et al., 2020). Multi-trillion-dollar recovery packages offer a huge opportunity (UNDP, 2020a) to capitalize on potential transformative changes to assist recovery from the pandemic and its economic consequences; they would allow investments to be made to simultaneously support efforts *against* climate change and *toward* achieving the SDGs. Such recovery resources would also provide an

opportunity to ensure that the glaring, and potentially growing, inequalities in the world are urgently addressed. How, then, can this unprecedented resource mobilization be channeled to rebuild a world that is more sustainable and more resilient, in keeping with the aspirations of Agenda 2030?

The need of the hour is to move toward *systemic* thinking and approaches (Zabaniotou, 2020). This is the only way to ensure that the investment potential of these considerable recovery packages can be leveraged to embed the structural changes required for longer-term sustainability and resilience and to reap the multiple dividends that they will confer.

The IIASA–ISC Initiative

In the early days of the global response to the COVID-19 pandemic, the International Institute for Applied Systems Analysis (IIASA) and the International Science Council (ISC) came together to study the crisis in its various facets and to help identify and define specific policy actions that would support recovery from the crisis along more permanent and accelerated pathways to sustainable development. The Initiative, entitled "Bouncing Forward Sustainably: Pathways to a post-COVID World," recognized the game-changing adaptive measures being rapidly implemented and adopted by society in response to the extreme vulnerabilities exposed by the COVID-19 crisis, in particular:

- the willingness of governments to respond, as needed, with effective, scientifically informed communication;
- the ability of businesses and society to innovate and respond constructively to the needs of the hour;
- the responsibilities taken on by individual entities, such as businesses and consumers, revealed in the choices and behavioral responses they exercised; and
- the consequent optimism among sustainability professionals that certain sustainability transformations could be within reach.

However, the Initiative also recognized the urgent need to support and accelerate the growth of such transformative green shoots to help them deliver, and maintain, a more sustainable and resilient society.

The IIASA–ISC initiative focused on four synergistic thematic areas. These were used as a lens through which to view how system-wide changes might be implemented:

- Governance for enhanced sustainable development: Governance—spanning norms, laws, conventions, market design, networks, processes, mechanisms, and how information and data are collected for decision making—determines the functioning of a social system and lies at the core of human–environment interactions. How can governance be reoriented so as to more intrinsically integrate sustainability considerations?
- Strengthening Science Systems: The close inter-linkages among social, environmental, and cultural systems, the highly interconnected global village, and the fast pace of current technological development—all these call for sustainability science support at a high level of robustness, agility, transparency, and accountability. How can the science system be strengthened to respond to these needs?
- Resilient Food Systems: The design and functioning of food systems are essential to human survival; they embody many aspects of equity and justice, are deeply vulnerable to climatic changes, and determine how resilient humans are to risks of all kinds. How can the potential of the world's food systems be unleashed to contribute to universal food and nutrition security, rural development, and a healthy environment?

- Sustainable energy: While energy is recognized as an enabler of economies and societies, energy choices and energy consumption have also resulted in contaminating the air and critically endangering the climate. How can an energy value chain be established that is sustainable from the source (fossil to renewable) through the production process (centralized to decentralized) to consumption (focusing on the drivers of demand)?

In the rapidly unfolding COVID-19 pandemic, with relevant scientific evidence still being gathered, the Initiative sought to identify feasible game-changing solutions to the global challenges revealed by the crisis. The approach used was transdisciplinary and systems-based. To supplement the evolving evidence base, the accumulated knowledge of groups of globally renowned academics, researchers, expert practitioners, and policymakers was harvested. These groups addressed the four themes outlined above—namely, governance, science systems, food systems, and sustainable energy. The groups were tasked with deliberating upon the specific interventions needed from the global to the local level to support the solutions identified and accelerate their implementation. All interventions were to be both sustainable and resilient.

Each theme has its own report: Enhancing Governance for Sustainability — Mechler et al. (2021); Strengthening Science Systems — Rovenskaya, Kaplan, and Sizov (2021); Resilient Food Systems — Sperling et al. (2020); and Rethinking energy solutions: Energy demand and decentralized solutions — Zakeri et al. (2021). This, the Synthesis Report, brings to the fore the specific interventions needed across the multiple themes that were put forward by experts during the consultations, and highlights their cross-cutting nature. Building on select key recommendations from the thematic reports, the Synthesis Report presents a shortlist of eight key recommendations with the potential for systemic transformation. The authors, exceptionally conscious of the equity and resilience dimensions of a new sustainable future, have also sought to be practical, by prioritizing the transformative changes that seem most feasible and that could make a *significant* contribution to a sustainable and resilient world.

All five reports can be accessed on covid19.iiasa.ac.at/isc/outcome

Key Recommendation 1: Strengthen knowledge base on, and preparedness for, compound and systemic risks

> “… without good disaster risk governance, bad situations only get worse …. Good disaster risk governance means acting on science and evidence.”
>
> **António Guterres**, UN Secretary-General (United Nations News, 13 October 2020)

Given the complex and systemic nature of an ever-growing risk landscape, science-based evidence and insights are essential for understanding and anticipating specific manifestations of risks and for designing effective risk-management and governance approaches. As risks are multidimensional, the scientific knowledge required to address crises must be drawn from many intersecting disciplines. Moreover, scientific approaches to problem-solving must be not only truly transdisciplinary but also inclusive, reaching out to policymakers, the private sector, and the citizenry to inform their analyses and recommendations.

Global risks are becoming increasingly complex and systemic in nature, straining governance systems at multiple levels

The body of scientific knowledge on interconnected, compound, interacting, evolving, and cascading risks has been increasing over the last few years (Hochrainer-Stigler, 2020). The validity of a systems-based approach has become evident as the world tries to deal with the resource-draining hold exerted by COVID-19. The pandemic shows how risks are increasingly becoming compound (multiple, otherwise-unrelated hazards interacting simultaneously or successively), systemic (with interdependencies across socio-ecological systems, regions, and scales), and leading to cascading and existential impacts. The manner in which risks play themselves out, and particularly the way in which different societies are affected by them and respond to them, shows considerable variation, as exemplified by the unequal impacts of COVID-19. Global responses and local contexts are both important. There are numerous reports of this crisis impacting the ability of health systems to deal with even normal health issues. Governance and management systems throughout the world are struggling to address numerous crises occurring simultaneously and with greater frequency and intensity. Examples abound: the race-related riots in the United States, floods in India, the conflict in Syria, large-scale migration, climate change, and many others.

The United Nations Office for Disaster Risk Reduction, while emphasizing the importance of recognizing the increased threats of compound disasters (Liu and Huang, 2015, p.19) has concluded that “it is unlikely that such timely and adequate responses (to inter-disaster linkages) can all be pre-planned.” Ahead of the outbreak, however, health experts had, in fact, published numerous warnings of a new strain of the coronavirus. Where science possibly fell short was in translating that warning into an understanding of the possible speed and scale of transmission of COVID-19 in an interconnected world, the consequences of limited response measures, and

the ability of the virus to rapidly mutate. An improved understanding of the disaster risks in different parts of the world and of the existing response capacities make it possible to simulate the impact of single disasters. However, analyzing compound disasters/crises, even though this involves high uncertainties, can strengthen risk responsiveness by preemptively identifying resource mobilization needs and strengthening management structures.

Disaster management institutions must be mandated, and empowered, to address compound and systemic risks systemically based on strong inputs from science

The Sendai Framework for Disaster Risk Reduction (United Nations, 2015a) includes in its targets a specific call to substantially increase the number of countries with national and local disaster risk reduction strategies by 2020 and to make multi-hazard early warning systems and disaster risk information and assessments available and accessible to populations by 2030. Much has been achieved at both national and global scales with respect to improved disaster preparedness and reducing the impacts of disasters on people and infrastructures; however, the focus on compound and systemic risks urgently needs strengthening.

As a study of the disaster management plans in five States in India undertaken under the Climate and Development Knowledge Network (CDKN) initiative highlighted:

> To a large extent, the state disaster management authorities only collect data after a disaster has happened; the systematic collection of data on pre-disaster conditions would help them to measure states' ability to anticipate, absorb and adapt to shocks and stresses (Bahadur et al. 2016, p.26).

The above refers to dealing with single disaster events. The same report also identifies the need for authorities to consider all stages of the disaster management cycle, as opposed to their current emphasis on response and relief "due to different factors, including the lack of clarity regarding roles, responsibilities and financing for risk-reduction activities" (Bahadur et al. 2016, p.33).

To address the spectrum of likely risks, governments should consider identifying the individuals and institutions that are best positioned to provide the requisite research: research that can then be linked together and rapidly mobilized in the event of a crisis before an actual disaster occurs. As crises are more and more multi-dimensional, "emergency teams" should possess relevant and complementary expertise in the different disciplines needed to deal with particular kinds of exogenous shocks. These "emergency teams" should exist in a stand-by mode, ready to be activated as and when required. Emergency funding for the work of such emergency teams should be readily available to avoid the delays associated with routine funding procedures.

Agility, reliability, and relevance of science are key to effective resilience and responsiveness

Analysis of the COVID-19 crisis reveals that if the science system is to be in a position to react more efficiently and more effectively to future global threats, it needs to improve in three major ways. First, it needs *increased agility*: the science system needs to be able to react swiftly to newly emerging and rapidly unfolding issues at national and international levels, as appropriate. Second, it needs *greater reliability*: the science system will have to improve the quality of its output. Third, it needs *increased relevance to society*: the science system will have to be more effectively linked to policy and to the public and the challenges they face. The objective should

be to ensure that the science system improves its performance in all three aspects simultaneously and moves to a new frontier of agility, reliability, and relevance (Rovenskaya, Kaplan, and Sizov, 2021).

Scientific capacity develops best in well-resourced and stable research institutions with long-term funding. COVID-19 has demonstrated how difficult it is for poorly endowed and poorly prepared research institutions to respond with agility and scientific excellence to sudden threats, and also what this lack of agility can cost society in terms of human and economic losses. Part of the problem is that research is concentrated in and on countries and groups endowed with adequate resources (*Nature*, 2016), yet in our strongly interconnected world, global vulnerability is defined by the vulnerability of the weakest part. Capacity at the local level is critical, as it can produce the evidence necessary to develop effective, context-specific strategies to mitigate risks. As research capacities develop over time, it is vital to provide adequate, reliable, and ongoing public funding to institutions undertaking research on societal risks.

To enhance the reliability and relevance of the science system, much stronger research and evidence is needed on i) assessing the pathways through which emerging and novel crises could pose systemic risks at various scales; ii) stress testing socioeconomic systems for individual and compound hazards at relevant scales; iii) adaptive management approaches for managing crises in the face of uncertainty and the mechanisms by which these can be addressed; and iv) how to boost inclusive, whole society approaches to reducing risk in the face of uncertainty.

Key Recommendation 2: Repurpose and redesign global institutions for the complexities of the 21st century

> “Multilateral co-operation today is in a state of profound crisis. COVID-19 has swept through every part of the world since the start of 2020, leaving a devastating cost - first and foremost in human lives, but also in terms of economic growth, political momentum, and social inequality. …the crises we are living through at the moment … are all too complex and multi-faceted for any one nation to tackle them on its own. What is needed is an effective system of multilateral cooperation to tackle the shared problems we face.”
>
> **Mary Robinson**, Chair of the Advisory Board of the IIASA–ISC Consultative Science Platform: Chatham House, 10 July 2020.

2

Global institutions and processes must adapt to new and emerging contexts

The COVID-19 pandemic vividly illustrates that today’s challenges are not occurring in isolation but, given the interdependence of much of our global economy and critical institutional and physical infrastructures, are closely interconnected. To enable a shift toward more sustainable futures, it is crucial, if not indispensable, to reform current global governance arrangements to create a system of more cooperative and responsive international organizations able to identify and redress key drivers of risk before they manifest. The global pandemic is a warning of the challenges that lie ahead in a world driven by spiraling climate change, ecosystem collapse, and dwindling resources. The pandemic also sharply illustrates the need to rethink the existing paradigms and structures of international cooperation: to work toward a framework within which the global community can engage in multidirectional and more integrated learning, problem identification, and decision-making—one that will enable the necessary shift toward more sustainable, equitable development in an increasingly riskier world. One of today's urgent priorities is thus to assess the adequacy of the global institutions supporting international cooperation, not only the UN agencies but also the large number of institutions supporting the multilateral cooperation system. COVID-19 has revealed the weaknesses of these systems and the need to enhance the risk governance mechanisms across these institutions and systems to empower them to give greater prominence to risk management. The responsibility for international cooperation lies with the countries themselves. However, a strong system to encourage and support international cooperation effectively and enable a more coordinated to crises is essential. Such a system could help mitigate or even avoid the unintended consequences of the response measures currently being witnessed in many countries. When faced with the pandemic, countries strengthened their inward-looking policies at a time when numerous experts were stressing the need for international cooperation to address the global crisis the pandemic had caused. A strong network of institutions coupled with a greater trust in these institutions could perhaps have led to a different kind of behavior and responsiveness worldwide.

Ongoing reform process of the United Nations and other international organizations needs to be urgently completed

Long before the COVID-19 crisis, there were repeated calls for the reform of the UN system, and several reform initiatives have been tried over the years. The most recent and comprehensive of these, launched in May 2018, centers on three key pillars: development, management, and peace and security (Apap and de los Fayos Alonso, 2019).

This new reform process is being praised as bolder and more comprehensive than its predecessors. Could the lessons of COVID-19, however, inspire even bolder reforms? Could they address the degree of institutional fragmentation inside the UN that often leads to competition and overlapping mandates and that will remain even after this reform process is implemented? And should the adoption of a broader concept of security—one that includes addressing individual vulnerabilities requiring different types of safety nets—be part of this new reform? Could the lessons of COVID-19 inspire a process of a much bolder transformation in the UN with multilateral cooperation across traditional socioeconomic sectors being significantly strengthened and more coordinated?

"Virtual" webs of security to protect the vulnerable must be created

The COVID-19 crisis has revealed vulnerabilities in all sectors, highlighting the need for "virtual" webs of security, namely, defined mechanisms of coordination across organizations responsible for interconnected issues that will enable timely implementation of systems-level strategies and responses to protect vulnerable populations. These virtual webs should be created at global, regional, national, and local levels. Lack of access to basic services, such as water and sanitation, and informal employment situations are forcing many people in developing countries to make impossible choices between following pandemic-driven social distancing measures or maintaining basic income and access to food. The impact of COVID-19 on food systems relates primarily to employment and income rather than to agricultural production per se. Job and income losses, insufficient safety nets, and constraints on local access to food have created conditions for food insecurity for many households and revealed additional inequalities within and across societies. The COVID-19 crisis and rising levels of poverty have uncovered significant weaknesses, and in some case, a complete absence of safety nets for the less privileged. In many countries existing social safety nets have been insufficient to absorb the socioeconomic impacts of the pandemic**.** This is illustrated by the rapidly growing number of countries that have introduced or expanded social protection measures estimated to reach 1.7 billion people. Gentilini et al. (2020) found that nearly 195 countries have implemented at least some additional social protection measures in the wake of the ongoing COVID-19 pandemic. COVID-19 has shown the importance of broadening the definition of security, and specifically that of national and individual security. The definition must include not only security and necessary support for jobs and income but also health, water, and individual security, among others. As far as security is concerned, a systemic approach should be taken to identify the factors most critical to giving people not only a safe and decent life but also a sense of empowerment. Safety nets are required now more than ever to help increase access to essential services such as energy services for the poor and vulnerable and also to make energy services affordable for all (OECD, Livelihoods, 2020). In the longer term, energy safety nets could have multiple benefits and be linked to energy-efficiency programs, for instance through soft loans and subsidies to permit low-income populations to buy energy-efficient, easy-to-repair appliances that reduce the impact of energy price increases on welfare, and consequently reduce energy poverty (Sustainable Energy For All, 2020). Addressing the prevailing vulnerabilities and inequities that have been exacerbated by the COVID-19 pandemic

is imperative for building resilience and overcoming long-standing gaps in existing policies and efforts toward equitable and just energy transitions (Zakeri et al., 2021).

Key Recommendation 3: Advance toward smart, evidence-based, adaptive, good governance arrangements at all levels

> “The greatest glory in living lies not in never falling, but in rising every time we fall.”
>
> **Nelson Mandela**, Speech at The White House, Washington, D.C., 23 September 1998

Given the increasing fragmentation of global governance, the growth of multiple and compound hazards, and in the spirit of leaving no one behind, governance systems across all scales and sectors are responsible for ensuring the security and well-being of both present and future generations. Governance systems have to keep pace with the rapidly evolving challenges of a smart, interconnected, complex, hazardous, and increasingly unequal world. They must also, in the interests of furthering the development gains of the past and achieving the SDGs, respond—on the basis of robust, systemic evidence regarding impacts and response measures—to the compound, systemic risks that the world is facing (Jacobzone et al., 2020). The Organisation for Economic Co-operation and Development (OECD) has asserted: "Responding to COVID19: The rules of good governance apply now more than ever![1]" (OECD, COVID, 2020). The consultations during the IIASA–ISC Initiative were in line with this assertion. But they revealed, too, that governance needs to have the additional attributes, mentioned above, of being smart, agile, and science-based.

The science–policy interface must be strengthened

As the current crisis has evolved, some of the major systemic weaknesses of the science–policy interface have become apparent in many countries. Indeed, experience of tackling the COVID-19 pandemic has shown what a challenge it can be to ensure that policies are informed by science. Strengthening the role of science in informing policy requires the science–policy interface to be institutionalized and for the institutions in question to be robust, transparent, and accountable. In fact, even in countries where the science–policy interface is more strongly institutionalized, the COVID-19 pandemic has made clear how much room there is for improvement. Science–policy institutions need to be long-lasting and well provided-for with stable and predictable sources of funding.

The science–policy interface is critical at the international level, too. And, for global governance to be effective, this global-level interface has to be informed by countries' contextual diversities and socioeconomic sensitivities.

[1] The Council of Europe suggests the following: 1. Participation, Representation, Fair Conduct of Elections 2. Responsiveness 3. Efficiency and Effectiveness 4. Openness and Transparency 5. Rule of Law 6. Ethical Conduct 7. Competence and Capacity 8. Innovation and Openness to Change 9. Sustainability and Long-term Orientation 10. Sound Financial Management 11 .Human Rights, Cultural Diversity and Social Cohesion 12. Accountability [https://www.coe.int/en/web/good-governance/12-principles]

For this, the breadth and depth of international cooperation among institutions offering science–policy advice must be enhanced. International collaboration allows for evidence-sharing and the emergence of a scientific consensus that can be communicated to policymakers. Scientific consensus, based on international global scientific collaboration, is especially critical for anticipating future global challenges and threats, and thus for allowing policymakers to take preemptive and timely action.

Many countries are able to solicit scientific advice from science advisors, advisory boards, and task forces consisting of relevant experts (Gluckman and Wilsdon, 2016). However, the membership and activities of such bodies need to be more transparent and comprehensive. As the COVID-19 pandemic has evolved, so, too, have science–policy advice institutions and practices. While some general requirements for effective policy advice are evident, such as the need for transparency and for advice that is broadly based in terms of scientific disciplines, there is clearly no single institutional form that is appropriate for all countries. Governments need to learn from different countries' experience how effectively different systems have operated in practice; they should then, on the basis of this information, establish scientific advisory processes that take their own needs and resources into account.

Good governance also means more integrated governance with measurable SDG outcomes

Policy coherence at global, national, and local levels is urgently needed to enhance resilience to deal with multiple hazards and also to exploit the opportunities to reap multiple dividends as recovery resources begin to be invested in redeveloping and, possibly reforming, socioeconomic systems. The institutions of multilateral governance, which are currently organized under clear thematic focus areas, also need to develop a web of cohesive, institutionalized hazard-based knowledge bases and response strategies that are able to stand the test of crisis response.

Boosting accountability and transparency as part of global governance reform is critical if such a reform process is to be enabled and successfully strengthened in the long run. This also holds true for governance in national systems challenged by COVID-19 and other recent crises. Options for enhancing accountability and transparency include boosting stakeholder participation in, and access to, monitoring and evaluation processes such as monitoring and reporting on the Sustainable Development Goals, as well as establishing safeguarded mechanisms for sharing data and information, especially at times of crisis. Good country practice such as initiatives in New Zealand to develop integrated data infrastructures offer inspiration for establishing similar provisions at global levels (Stats NZ, 2017).

"Smart" cities must be accompanied by "smart" governance

The world got its first smart city nearly half a century ago, but the trend of making cities "smart" took off almost a decade later and is still evolving. There is no widely accepted definition of what makes a city smart—different cities have incorporated varying levels of digitalization and information flows as a result of their deployment of Information and Communications Technologies (ICT). However, the cities that have deployed ICT technologies are now first off the starting blocks in being able to rapidly assess the impacts of policy measures such as the pandemic lock-down.

The United Kingdom (UK) set up Urban Observatories (UO) across the nation just a few years ago to apply scientific techniques for measuring planned and unplanned interventions in cities. James et al. (2020) utilized

the existing Urban Observatory Internet of Things (IoT) data and analytics infrastructure in the city of Newcastle to track the effectiveness of UK government policy interventions and the resulting social changes. Four critical conclusions from their analysis indicated the importance of: long-standing trust relationships built up between the UO team and local officials; the fact that the infrastructure was already in place with sensors, data, and analysis capacity established/installed over the last five years; the capture of long-term data baselines and city metrics to grasp the interdependencies and linkages in complex systems; and having real-time data and analytics in a city context for dealing with crises. The data thus generated are an essential condition for achieving the three axes of improvement referred to in Recommendation 1, but they have to be accompanied by a deep scientific understanding of the causal relationships and, of course, the ability to deploy this science in governance responses. "This year's Smart City Index suggests that the cities that have been able to combine technologies, leadership, and a strong culture of 'living and acting together' should be able to better withstand the most damaging effects of such crises," according to Bruno Lanvin, President of the IMD Smart City Observatory (IMD World Competitiveness Centre, 2020).

Key Recommendation 4: Partnerships key to sustainability solutions

> “ The Lesson from COVID-19 is that We Need More, Not Less, Global Cooperation. ”
>
> **Ban Ki-moon**, Opinion, *Newsweek*, 20 December 2020.

Agenda 2030 (United Nations, 2015a) calls on the global community to "Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries (17.16) … [and] Encourage and promote effective public, public–private and civil society partnerships, building on the experience and resourcing strategies of partnerships (17.17)".

The design of a sustainable new world needs multi-stakeholder partnerships

The COVID-19 crisis has provided the most significant opportunity since World War II to redesign economic structures and influence societal choices—informed by lessons from decades of embracing new technologies and processes with incomplete foresight, particularly with respect to their systemic social and environmental impacts. Many refer to this as humanity’s moment to pull back from the threat of catastrophic climate/natural change and to meet the SDGs. As this redesign will very likely imply significant changes to "life-as-usual," ensuring the active engagement of all stakeholders is an imperative for success. Fortunately for the world, the spread of information technology, admittedly still uneven, and the development of new tools of engagement have made it possible to fast-track the co-design and co-creation of alternative, more inclusive, and sustainable world systems. Adopting a participative approach at all scales would also ensure that the redesign reflects local contexts and capabilities and provides an opportunity to customize the transitional pathways of future development.

Science and science systems must also be more inclusive

As mentioned in Recommendation 3, governance for sustainability has to be based on scientific evidence, among other attributes. Science, too, needs to strengthen partnerships, with both interdisciplinary and transdisciplinary actors, to increase the relevance and applicability of the knowledge produced, and to ensure that the evidence base on which redesign takes place is itself partnership-based.

Incentives must be created if the scientific system and societies/communities are to engage in processes of deliberative societal dialogue about the creation and use of new knowledge. In addition to scientific merit, journals and funders should score social engagement on the part of authors as a positive factor in accepting

SDG-linked publications and projects. It should be recognized that public engagement is costly and can be politically risky. Serious attention should be given to finding cost- and effort-efficient ways of growing citizen engagement in science, and thereby to democratize science.

The private sector is a key partner in the sustainable development process

On 19 August 2019, the Business Roundtable, a group of leading CEOs in the USA which has been periodically issuing Principles of Corporate Governance since 1978, released a statement committing to lead their companies for the benefit of all stakeholders, including customers, employees, suppliers, communities, and shareholders, thereby moving away from the view that shareholder profit is the sole purpose of corporations. In another initiative, more than 1,000 companies committed to Science-Based Targets for reducing their emissions of greenhouse gases (Business Roundtable, 2019). These and other initiatives have strongly signaled the willingness of the corporate sector to be a vital part of the sustainability solution space. This means that, like other stakeholders, science and governance will have to partner with the private sector to facilitate broad-based, holistic transformations toward sustainability and to leverage private-sector expertise to strengthen the impact of science.

The private sector is the custodian of most global resources and the accelerator of new adaptive technologies and products—as evidenced by its fast-tracked production of new products and services, including ventilators, diagnostic tools, and, most significantly, innovation in vaccines (Rovenskaya, Kaplan, and Sizov, 2021). Engaging it constructively in the process of redesigning economies and societies is thus essential to ensure inclusive, resilient, and sustainable development for all. Technology platforms developed in the private sector, most notably in ICT, have been critical to many COVID-19 related initiatives. The World Health Organization (WHO) has sought the support of technology companies to develop solutions in response to COVID-19 such as population screening, tracking the infection, and designing targeted actions. "We need your commitment… We can only tackle this global threat—and get our economy back on track—by working together," said WHO Director-General Dr. Tedros Adhanom Ghebreyesus addressing digital technology companies (WHO, Digital, 2020).

International collaboration is necessary for furthering national interests

Reflecting on the experiences from the COVID-19 pandemic, the International Chamber of Commerce (2020, p.1) recently concluded:

> The COVID-19 pandemic has spotlighted the crucial need for international scientific collaboration in both the public and private sectors… International cross-border scientific collaboration including between public and private researchers should be supported, and policies and regulations that could hinder this international collaboration and exchange avoided.

International scientific cooperation is important for all countries and for the scientific endeavor in general. However, for countries whose capacities are limited, developing networks and mechanisms to tap into knowledge developed elsewhere assume far greater importance. The COVID-19 crisis has demonstrated examples of countries with very limited scientific capacities that were able to draw on the experiences of other countries or international organizations such as the WHO, to develop effective and timely policy responses. The

Democratic Republic of the Congo, for example, relied strongly on foreign and international organizations at all stages of the COVID-19 crisis (International Committee of the Red Cross, 2020; WHO, Congo, 2020). At the same time, the inability to adequately reflect local contexts in the design of science and solutions would significantly reduce the efficacy of global solutions, as seen in the handling of the COVID-19 crisis by governments and other stakeholders around the world.

The global recession and reduced fiscal space of many countries threaten to widen the technology and capacity gaps between countries. An unprecedented volume of fiscal stimulus packages is being issued, and it is important for these to be linked to maintaining and strengthening international collaboration.

Key Recommendation 5: Create a pervasive, sustainable knowledge society

> “Any fool can know. The point is to understand.”
>
> **Albert Einstein**

In the early days of the pandemic, governments mainly sought scientific advice on combating the health emergency resulting from COVID-19. Increasingly, however, the advice of scientists has also been sought in relation to policies to address the adverse social and economic consequences of the pandemic. Among the most complex problems faced by governments are the trade-offs between various policies, particularly as policies that slow down the spread of the virus entail significant negative economic and social costs and consequences. The scientific community has to be better prepared for providing scientific advice on compound, systemic risks (Key Recommendation 1). Moreover, the policymaking community needs to be aware of the systemic interlinkages that would increase socioeconomic vulnerabilities to such risks.

Trust in science must be restored

The response to COVID-19 saw not only an increasing demand for inputs from science but also, frequently, a push back against the inputs/advice being provided by the scientific community. Political exigencies seemed to overtake scientific prudence, with response measures sometimes going unchallenged due to: i) a lack of transparency, access to, and comprehensible communication of science; ii) inadequate formal mechanisms to present nuanced and coherent advice to the policymaking community and society at large; and iii) an uncontrolled spread of fake and false news accompanied by falling levels of trust in institutions of governance.

It will be a challenging and painstaking, but necessary, task to pull back from the situation just outlined to rebuild trust in science and the institutions of science. This trust is essential for societies to function effectively and move toward greater sustainability. The agility required to ensure more effective science, as mentioned in Key Recommendation 1, plus a move to open science where researchers are incentivized to make data, models, computer codes, and even some interim products of research open and easily accessible, are necessary but not sufficient conditions for trust building. A concerted effort drawing stakeholders from across the science system and from the user community must be launched, possibly under the aegis of the International Science Council, to prepare a blueprint for this effort.

Science systems must promote systemic understanding

COVID-19 has evolved into a multi-faceted crisis. Dealing with it requires a systemic approach, and this will likely also be the case with several emerging risks that have been identified. Systemic thinking provides a better understanding of “the multiple implications of decisions and (in)actions in face of such a complex situation involving many interconnected factors” (Rovenskaya, Kaplan, and Sizov, 2021, p. 48). Research on risks should

be interdisciplinary, and the social and behavioral sciences should work together with disciplines that have primary relevance to the crisis at hand (medical in the case of COVID-19). This will enable systemic understanding of the crisis as well as appropriate systemic solutions that will exploit the multiple dividends that are possible.

This approach entails implementation of a number of improvements to the science—including setting research agendas and research funding incentive systems. Researchers should be incentivized to undertake socially relevant research, and the science progression system should recognize the value of, and need for, systemic science that is also solution-focused.

Research that would lead to building greater resilience and more effective response measures also has to respond to the complexities and coherence requirements of real-life conditions. Scientists must recognize that policymakers are confronted with a plethora of science-based and non-science-based considerations and that they always interpret any knowledge they acquire in a political context. As such, a dialogue between scientists and policymakers as two partners based on co-design and co-production principles should be promoted (Rovenskaya, Kaplan, and Sizov, 2021).

Science must be inclusive and accessible

The inability of individual countries to deal with crises exposes all countries to risk due to global interconnectedness and the socioeconomic knock-on effects that may spiral across borders. However, as is evident, and as the Sendai Framework (United Nations, 2015b) recognizes, most developing countries have very limited scientific capacity. Moreover, research capacities are not evenly distributed within countries. It is therefore in the interests of all for the requisite research capacities to be developed at all relevant scales and regions, with necessary cross-border support—financial and technical—to ensure: i) more uniform scientific capabilities and ii) uniform scientific attention to regions. Effective local scientific capacity, apart from providing relevant contextual data and analyses for design of effective national/global response strategies, also enhances trust in science and the advice that science provides to policymakers.

Strengthening systemic science and science access in food systems:

Transformations in food systems must be designed for local contexts. Today, most of the public research on food systems takes place in developed countries, with an increasing focus on middle-income countries, but this research has a very limited capacity in low-income developing countries. This is despite the high interconnectedness of food systems and the complex supply chains that depend on them. The recovery packages must devote sufficient attention to fostering research and innovation, technology transfer, and scale-up of sustainable practices in order to build more resilient global food systems.
The role that technology and a digital economy play in buffering against impacts on the food system has become even more apparent during the months of pandemic. Innovations in technologies and practices are central for addressing immediate and long-term food security concerns. However, this should be complemented by a focus on bringing innovations into processes that aim to expand access to readily available solutions and practices, as this can improve productivity and environmental sustainability. There is a wide array of available sustainable land management, conservation agriculture, agroforestry practices with proven benefits for land productivity, biodiversity, and climate resilience. Considering the contraction in the fiscal space, particular in developing countries, an emphasis on knowledge transfer, improvement of extension

services, and adoption of existing good practices will be essential. However, a focus must be maintained on expanding the digital infrastructure in developing country regions to avoid a widening technological gap.

The responses to the COVID-19 crisis have revealed that systemic approaches are insufficiently appreciated in both the policymaking and academic communities. The capacities to apply systemic thinking and to undertake systemic analyses need to be urgently built up in all parts of the world. Action needs to be undertaken to enhance scientific capacity where this is not yet readily available, and to leverage the potential of knowledge-sharing provisions. Networking and global collaboration, always important for science, are especially important when preparing for, and dealing with, crises of a global nature where science needs to be agile.

Key Recommendation 6: Reset economic infrastructure and development for sustainability

> From the Business Sector, there is no intent nor viable route to return to Business as Usual. … we need to transform the systems in which we all operate. The focus in those transformations has to be on resolving climate change, avoiding further loss of nature and actually having a positive impact on nature. And last, but certainly not the least, taking a hard look at inequality and improving the situation there. For this … it is essential that we need to change the economic system itself. We can no longer reach or build forward a better economy if we continue to only optimize financial capital. We must integrate natural capital and social capital into what we call performance.
>
> **Peter Bakker**, President and CEO, WBCSD, at the IIASA–ISC Webinar (IIASA, 2020)

6

In exploring the responses to the pandemic that have already been put in place and the opportunities that have arisen as a result, the Initiative deliberated upon several restructuring/reorganization measures that would meet the twin objectives of more inclusive economic growth and more sustainable development. If nurtured responsibly, these seem feasible today. This is by no means an exhaustive list but a reflection of what emerged from the consultations on the four themes and focusing on the low hanging fruit. However, every recommendation, although broadly applicable, may not be universal.

A new "glocalization" must be conceived and implemented

A more conscious approach to the mix of globalization and localization is needed across several sectors, including energy and food production, as a means of achieving more context-specific, employment-generating, and resilient and equitable development. As the highly subsidized fossil energy industry is struggling to survive post-pandemic, governments have the choice of directing recovery resources to fast-track a transition to renewable energy sources of energy. Doing this, while at the same time instituting more secure global supply chains for renewable energy technologies, will provide an opportunity to develop more decentralized, employment-generating, contextually relevant renewable energy systems. This opportunity must be exploited rather than reliance being placed on establishing large utility scale renewable energy systems, something which is a feature of current policies and trends. The push to design decentralized energy systems must be based on the participation of local actors, such as cities and communities, and use small and micro-enterprises to provide energy services. This will change the structure and governance of the energy sector toward a multi-actor arrangement.

As is well known, decentralized renewable energy solutions offer cost-effective and rapidly deployable modular solutions, increase the resilience of energy systems to natural and human-made disasters, and secure the provision of crucial services and infrastructure, such as healthcare facilities in the event of an energy service interruption. Through open and participatory processes, decentralization also empowers communities to choose

energy sources and technologies that provide the energy services which most benefits their community (Grubler et al., 2018).

In the area of food systems, a new balance needs to be struck: i) between catering to the exotic needs of distant markets and achieving the nutritional security and resilience of local populations, and ii) between stagnation in small farm structures and the uncontrolled development into single-purpose large-scale agribusiness companies. This balance would determine the need for supply chain infrastructure and associated energy solutions—an issue of particular concern to developing countries. Digitalized access to markets and innovative models of agricultural production that improve both efficiency and resilience can secure both the food system and the farming community (Fritz et al., 2019).

Given the importance of agricultural activities to livelihoods, particularly in developing country economies, it is important for the adoption of new, smarter technologies to take the local context into consideration. This should not come at the expense of employment and livelihood security, but should rather strengthen education, retraining, and skills development and other forms of social support to fight the effects of the pandemic and support the recovery process.

Urban spaces and use must be repurposed toward sustainable living and wellbeing

Cities account for three-quarters of human-caused carbon dioxide emissions and an estimated two-thirds of global final energy use; 55% of the world's population lives in cities (with 2.5 billion more expected by 2050); 80% of global GDP is generated in cities; and one billion people are currently living in urban spaces (Ren21, 2020).

COVID 19 has revealed the potential for remote functioning, digitalized working across all sectors, innovations in business models, redesign of workspaces and uses, and the creation of an enabling environment for reorganizing urban spaces and facilities toward socially acceptable sustainability. These adaptations, particularly remote functioning and digitalized services, demonstrate the feasibility of redesigning cities into connected urban villages that incorporate a variety of mixed uses and, moreover, prioritize space for sustainable living, working, mobility, and leisure. Wherever feasible, these sustainability-positive transformative adaptations need to be mainstreamed through concrete policies and measures, investments, and financial incentives, such as applying holistic approaches to urban planning to deal with multiple challenges, empowering local governments to take action, and promoting nature-based solutions.

The COVID-19 crisis is providing some of the best examples of how cities around the world are adapting to a new normal—Milan's open streets plan, San Francisco "slow streets" campaign; the introduction of 80 kilometers of temporary bike lanes in Bogotà; conversion of over 100 streets for pedestrian use in Buenos Aires; Paris, even before COVID-19, with its call for self-sufficient neighborhoods; and several cities around the world promoting 20-minute neighborhoods with all the amenities needed within walking distance (Straface, 2020) The success of these initiatives should encourage city governments around the world to convert more roads for similar purposes, especially as a large number of car trips in cities are less than 5 km and cars are parked for 96% of the time. These cities are showing not only the importance of designing people-centered cities, but also that it is possible to make major changes to improve the use of public space and public safety, mobility, and overall livability. And, by making these drastic changes, the cities have experienced improvements in the quality

of life while managing to remain competitive, and attract tourism, investment, and economic activity. A global shift toward remote work can also reduce the pressure on traditional transport systems.

The focus on efficiency has to be counter-balanced by sustainable and resilient perspectives

A focus on efficiency gains has been a key driver of the evolution of socioeconomic systems, including food, as well as energy. While energy is dealt with in Key Recommendation 8, this section focuses on food. The food focus has contributed to increased agricultural productivity, while reducing the expansion of agricultural land. It has also led to increasingly complex agri-food businesses, long supply chains, and a homogenization of agricultural practices together with air and water pollution and soil degradation. Efficiency is important, but it needs to be accompanied by a focus on resilience, equity, and sustainability perspectives. The pandemic revealed the interdependencies and vulnerabilities in current food systems, including the dependency of some value chains on migrant workers. While global food stocks have remained robust throughout the pandemic, key impacts on the food system have been felt through rising unemployment, declining incomes, shifting demand, and disrupted local supply chains. Rising levels of food and nutritional insecurity have highlighted the inadequacy of existing social safety nets in developing countries and in many developed countries. This has also been reflected through the growing number of countries expanding food assistance programs, social protection schemes, and safety nets during the pandemic.

The prevailing emphasis on maximizing financial returns is insufficient for shaping food system architecture in a sustainable manner and meeting its intertwined social, economic, and environmental challenges. The food system needs simultaneously to facilitate rural development and achievement of food and nutrition security, as these are only too often directly connected. Approaching the food system as an efficiency-maximizing logistics service threatens sustainability in the entire value chain of the food sector. The length and complexity of the food supply chain, and its drivers in terms of incentive structures, have to be clearly linked to the context in which this chain is situated and its capacity to absorb and adapt to socioeconomic and environmental shocks. The efficiency concept needs to be expanded from a sole focus on profits to a focus on all the dimensions of sustainability, with a particular focus on resilience.

Redirecting demand toward services and promoting a sharing economy can enhance employment

Undoubtedly, the effect of the COVID-19 response measures, which have resulted in lockdowns and shifts toward remote working, have had an adverse effect on certain shared services, such as shared mobility. However, the months since the pandemic began have also seen a boom in the demand for other services, such as the home delivery system, which has resulted in rapid growth and increased employment in these sectors while at the same time promoting a more prudent assessment of needs. This holds promise for more sustainable consumption patterns and reduced footprints.

The increasing comfort with remote working and functioning, across sectors such as industry, services, education etc., could—if supported well through longer term strategic incentives—leads to a much greater demand for shared and multifunctional workspaces while reviving the demand for shared mobility services and other shared home services. A clear focus in the recovery packages on such economic restructuring could replace resource-intensive capital goods production with greater productivity of capital employed, resulting in

a transformational shift to more sustainable consumption and production, more localized economies, and enormous opportunities for entrepreneurship at the small and medium scales.

Undoubtedly, too, regulatory frameworks that promote a fair and effective sharing economy and reduce social and other risks must be implemented; examples of these would be protection of consumer interests, adaptation of existing tax frameworks to ensure a fair share of value added is captured by the state, and the shaping of labor laws to ensure companies adhere to legitimate rules. In the light of poverty and inequality considerations, the limitations to sharing need to be addressed. Fair use of shared systems and things need to be resolved, and as access to these services by the disadvantaged populations can be put at risk, solutions specific to those populations are needed.

Promote investments toward building a sustainable and resilient world

The success of the above recommendations, and consequent entry points toward sustainability transformations, are all closely linked to the manner in which the unprecedently large recovery packages are deployed. Governments, in partnership with relevant stakeholders, need to build on global sustainability and resilience tracking efforts by, for example, establishing a dedicated taskforce that promotes investment in building a resilient, just, and sustainable world, and also monitors and discourages unsustainable investments so that a return to the old patterns of unsustainable development is prevented. This taskforce could be mandated to develop an accompanying accountability system like the one used by the Taskforce on Climate-related Financial Disclosures. This system could be an *All-Risk Disclosure Mechanism* that addresses key socio-ecological risks (e.g., climate, biodiversity, infectious disease) for public and private investments**.** To ensure accountability and transparency, initiatives to assess the extent to which public funding contributes to or hinders progress toward achieving the SDGs and contributes to societal resilience should be mapped and mainstreamed in national budgets. Such an approach requires robust data, data analytics, as well as the capacity to integrate data across diverse sources and share data on all aspects of sustainable development and resilience-building following open data standards.

Key Recommendation 7: "Sustainable and resilient" have to be the new "mantra" for development

> "Of all the evils for which man has made himself responsible, none is so degrading, so shocking, or so brutal as his abuse of the better half of humanity; to me, the female sex is not the weaker sex."
> **Mahatma Gandhi**

That climate change will adversely affect the poor and marginalized has been argued strongly in the literature. Gender inequality has also been exacerbated by the COVID-19 crisis. As the recent policy brief by UN Women points out, "Across every sphere, from health to the economy, security to social protection, the impacts of COVID-19 are exacerbated for women and girls simply by virtue of their sex" (UN Women, 2020). COVID-19, another global crisis, has also held up a mirror to society. According to estimates by the United Nations Development Programme (UNDP) for "global human development," an indicator developed in 1990 that combines education, health, and living standards find that a decline is expected for a vast majority of countries—rich and poor, in 2020: for the first time since this measure was developed. Global per capita incomes are expected to fall by some 4%. And, according to the World Bank, some 40 to 60 million people could be pushed into poverty because of the COVID-19 crisis. This suggests that the world will feel the effects of COVID-19 for years to come. However, the effects will be unequal (UNDP, 2020b). Data from a recent study in several developing countries show that the negative economic impacts of the COVID-19 pandemic have tended to concentrate mainly among those who already had lower incomes prior to the pandemic. Data also showed higher levels of vulnerability on the part of households in countries with high levels of informality, as found in many developing countries. Because of the type of work that informal workers perform, the virus prevention policies introduced affected them more than others, leading to a loss of jobs, loss of livelihoods and food security, and loss of household welfare because of their reduced access to formal safety nets. The ability to benefit from digital technologies to work from home, for education, and other purposes was also limited for lower income sectors of the population and the informally employed.

Growing inequality and extreme vulnerability will stymie future growth and development

While economies have been severely hit by the measures adopted to contain the virus, digitalization has come to the rescue of several sectors and in the form of innovative services. The strong push provided to digitalization is very likely to continue into the future, accompanied by a transition toward greater automation and robotics, potentially leading to a vicious cycle of marginalization and poverty. Universal access to digital products and services has to be prioritized to break this cycle. According to António Guterres, UN Secretary-General (Guterres, 2020),

> High levels of inequality are associated with economic instability, corruption, financial crises, increased crime and poor physical and mental health. Discrimination, abuse and lack of access to

> justice define inequality for many, particularly indigenous people, migrants, refugees and minorities of all kinds. Such inequalities are a direct assault on human rights.

With nearly 70% of the world's population living with rising inequality in income and wealth terms, and with severe science-based warnings on increasing frequency and intensity of extreme events, including pandemics, COVID-19 has revealed the economy-breaking direct and indirect costs of managing vulnerable societies. Studies have shown that this inequality could have long-lasting implications for economic growth and development (Cingano, 2014; Ostry et al. 2014; Berg and Jonathan, 2017).

Continued inequality is leading to societal tipping points and must be urgently addressed

Evidence of inequalities leading to social conflicts has been provided by researchers for several decades now. A working paper by the Overseas Development Institute, analyzing perception data for over 15,000 individuals in 40 countries in 2014**,** concluded as follows:

> There is a strong body of evidence linking inequality with different forms of social conflict - for example with higher crime, lower social and institutional trust and political instability. … Perceptions of social conflict have a strong influence on people's demand for redistribution, even stronger than the effect of perceptions of fairness and social mobility. However, the effects seem to be stronger at lower levels of actual inequality and lower levels of actual social conflict, suggesting that governments and practitioners interested in acting upon inequality need to act quickly when inequality is starting to rise in order to capitalize the support towards redistributive policies (Takeuchi, 2014).

The COVID-19 pandemic by all accounts threatens to increase inequalities arising from job losses and economic restructuring.

Understanding of human security must be broadened to include systemic resilience

Science for systemic societal resilience needs to be a core government priority and at the center of government. Risk management should be enhanced through policies and interventions focused on systemic resilience. Among other things, this would include systemic and equitable investments in health and in physical and social infrastructure resilience. Risk analyses have tended to focus on the physical and economic dimensions, but social vulnerability is generally poorly researched. Insufficient attention is given to the analysis of compound hazards and of factors affecting exposure and vulnerability. A set of policy actions might include the following: effective coordination and systemic decision processes across levels of government; defining clear roles and recognition for civil society and the private sector as relevant transformation agents; strong focus on, and accountability for, ensuring solidarity with the most vulnerable; seeking to further establish and upgrade health, education, and social protection systems to create a web of systemic security for all; and enhancement of human development and resilience; ongoing support extended to decision-making and accountability across ministries, agencies, and other actors for systemic investments through the mobilization of science communities and science advisors. This could further involve roundtables across ministries and agencies, civil society, communities, private sector, and lead to policy advisory bodies that exist at arm's length from government.

To build social resilience, recovery packages must be designed to address inequities

Given the compound systemic risks faced by humanity, as defined in Key Recommendation 1, many governments have set aside unprecedented financial resources to restart economies. It is critically important to devise and implement a science-based tracking mechanism to assess the degree of alignment of the recovery packages with SDG ambitions and focus on generating systemic resilience. This mechanism could build on ongoing COVID-19 response policy-tracking efforts, for example, the International Network for Government Science Advice (Allen et al., 2020). An explicit focus on equity and justice in immediate recovery efforts and medium- and longer-term transition policies is essential to reduce growing disparities and inequities, increase the resilience of disadvantaged and vulnerable groups, and ensure that the latter have a voice in decisions that affect them, namely, in health, water, energy, and climate governance. Policies and efforts to help those with limited resources, and those more vulnerable to shocks, need to be prioritized. An explicit focus on the social aspects of food and energy systems transitions is as important as the traditional techno-economic focus. This will specifically determine how society embraces, encourages, and supports transitions to low-carbon futures. Social safety nets are required now more than ever to help improve access to essential services for the poor and vulnerable and to make these services affordable for all. In sum, recovery packages should address multiple dividends across the social, economic, environmental spheres. In the area of energy, analyses have shown that with an economic recovery that favors green stimulus and reduction in fossil fuel investments, it is possible to avoid future warming. Unfortunately, since the beginning of the pandemic, the 30 major economies of the world have committed 53% of all public money for energy worldwide to the energy-intensive sectors and only 35% to clean energy (Energy Policy Tracker, 2020).

Key Recommendation 8: Harness the new consciousness in society

> “To the youth of today, I also have a wish to make: Be the script writers of your destiny and feature yourselves as stars that showed the way towards a brighter future.”
>
> **Nelson Mandela**

A recent survey-based report from McKinsey and Company, based on US data but likely applicable to most developed countries, revealed that customer behaviors and preferred interactions have changed significantly, with nearly 75% of people using digital channels for the first time and further indicated that they will continue to use them when things return to “normal.” And this was in May 2020, when the share of employees functioning remotely had gone up from 9% to 84% in the media and technology sectors, from 5% to over 70% in the professional and financial services sectors, 2% to 61% in manufacturing, and from 2% to 36% in health and education. According to the report, "Indeed, recent data show that we have vaulted five years forward in consumer and business digital adoption in a matter of around eight weeks” (Baig et al., 2020).

Another consultancy firm, Deloitte (Martinez, 2020) observed the following consumer behavior changes: increased online shopping, preference for local shops, focus on reliability, and price-conscious behavior, among others. It also highlighted interesting changes in company behaviors in response to these changes in consumer behaviors, resulting in: an increased focus on taking care of people, sustainability, and social concerns; reconsidering globalization; higher service levels; reexamination of business continuity and building business security.

While a number of these surveys have been undertaken in developed countries, it can be argued that the trends would be applicable to the richer segments of society in developing countries as well, where lifestyles are comparable. As the primary focus of the survey is on the consumption and lifestyles of the rich, the findings of the survey are likely to be generally applicable to several developing regions of the world.

Science-based policies need to encourage accelerated lifestyle changes toward sustainability

Roe et al. (2020) observed that the COVID-19 pandemic has in an unprecedentedly quick and radical manner, altered household production parameters and daily food consumption patterns. Documenting the changes in the patterns of expenditure on food of all types, those authors highlighted the shifts in home food provisioning and at-home meal preparation. For example, 60% of consumers in the USA reported cooking at home more often, made possible by lower number of working hours and time saved on commuting due to remote working. These shifts are expected to result in reduced wastage of food and increase the efficiency of household food production, as well as improving cooking and food management skills. Similar trends have also been observed in the UK.

Consumers have also reprioritized spending due to reduced incomes and changes in lifestyles. J. P. Morgan (2020) research analyzed consumer spending habits, noting specifically the double-digit declines in products that consumers had stopped spending on. In general, there was a significant shift away from spending on discretionary categories. The International Monetary Fund (2020) observed:

> In a number of advanced economies, readily available data on credit and debit card transactions and sales data from businesses show generally similar patterns of expenditure changes during the pandemic. Travel and transport, restaurants, some health services, personal care services, cultural and sports events, and some clothing items suffered sharp declines in demand.

While surveys have led to the expectation that some of these changes would become embedded in people's consumer behavior, policy guidance can, and must, be designed on remote functioning and incentive frameworks that promote more sustainable consumption and demand reduction. This is the collective responsibility of all sectors of society. Science has a key role in assessing the effects of the COVID-19 pandemic on demand and supply, governance, innovations, investments, and social equity and justice. Moreover, deeper understanding of how the pandemic will influence individual behavior, lifestyles, consumer choices, and social practices in the longer-term will be key. Science can make a valuable contribution to identifying and designing sound policy options in the short, medium, and long term with respect to this uncertainty. More and more targeted awareness-raising campaigns and education—if adequately designed—will improve attitudes and practices. Public understanding and trust in science can be enhanced through the improvement of communication and scientific knowledge. Active engagement between science and citizens is key. Communities and civil society play a central role by supporting sustainable consumption initiatives, engaging in policy dialogues toward sustainable consumption and production, supporting behavioral change processes, and facilitating awareness raising. Understanding behavioral changes and consumer beliefs, motivation biases and choices, and feeding the resulting insights into policy measures is essential to guide society to make lifestyle changes that favor more resource-efficient and low-carbon consumption patterns.

Remote functioning needs to be supported through systemic changes in institutional frameworks and infrastructure

In the immediate aftermath of near-global lockdowns there was euphoria about the very significant impact of COVID-19 response measures on GHG emissions. A paper by Liu et al. (2020) revealed "an abrupt 8.8% decrease in global CO_2 emissions (-1551 Mt CO_2) in the first half of 2020 compared to the same period in 2019". However, the same paper also observed these reductions diminishing as the lockdown eased.

Similarly, a number of papers have been published on the impact of the lockdowns on air quality in urban areas. Giani et al. (2020) presented the results of their modeling analyses on the impact of air pollution reductions on human health and concluded:

> In the short term, an estimated 24 200 premature deaths were averted throughout China between Feb 1 and March 31, and an estimated 2190 deaths were averted in Europe between Feb 21 and May 17. … We estimated that tens of thousands of premature deaths from air pollution were avoided.

Improvements in air quality also diminished with the lifting of lock-down. A carefully defined strategy will be required to continue to exploit the environmental benefits of remote working and its societal acceptance: this

will mean providing greater access to digital services and redefining the use of urban structures and spaces to facilitate productivity with substantially reduced footprints. Concepts of connected urban villages, introduced in the early 1980s, hold a renewed promise of providing digitally empowering, shared work/functional spaces accessible through non-motorized transport and enhanced community spaces for networking.

Governments must introduce policies and measures and regulatory frameworks, as well as incentives to influence their direction and to encourage businesses to adopt new business models to adapt to these changes, enabling them not only to survive but thrive in this new regime.

Energy demand reduction must be introduced as Target 7.4 under SDG 7

All data indicate that the world is not on track to meet the SDGs and the targets of the Paris Agreement. Getting back on track would require structural changes in the economy, lifestyles, production and consumption practices, transport, buildings, agriculture, and industry. Of all these, the one with the greatest urgency and potentially greater payoffs is that addressing demand and consumption patterns.

The above changes, introducing remote working and associated redesign of urban spaces as well as nudges toward more sustainable lifestyles, would clearly result in reducing demand for both energy and other resources. Placing a clear focus on demand reduction, especially for energy, would significantly strengthen the transformation toward sustainable energy for all; it would provide a push toward more sustainable mobility choices and a service economy, as highlighted in Key Recommendation 6. Energy demand reduction can be identified as the missing target in SDG 7: it has a key role in spurring cross-sectoral action and would facilitate the "integrated, indivisible" approach to SDGs from within.

Conclusion

The transformative changes recommended in this document deal largely with changes in the framework conditions within which economies and societies operate. They represent the low-hanging fruit that require relatively low levels of public investment but have the power to result in escalating transformative changes toward wider and more far-reaching transformations. Clearly, the pandemic has resulted in the breaking of new ground as far as social and economic structures and innovations are concerned—these green shoots have to be clearly identified, understood for their systemic implications, and encouraged as required.

The role of science and science systems featured prominently in all the consultations that took place in this Initiative. Of particular importance is the need to encourage systemic, solutions-oriented research along the research value chain—from setting research agendas to rewarding research outcomes. A strong message emanating from the initiative was the need for science to pervade society at all levels, which will require science capacity building and promotion at the most local levels—the criticality of taking science to the masses and not limiting it to the "elite," science that is open, accessible, and accountable.

The need to build resilience to multi-hazards and to harvest the multiple dividends from recovery packages and/or new investments by adopting systemic approaches was a very common refrain. The energy sector provided an excellent example of the potential returns, in terms of achieving SDG 7 on Sustainable Energy for All, by focusing more widely on urban repurposing and on pursuing the sustainable consumption agendas. This led to the strong recommendation (Key Recommendation 8) to consider a new SDG Target 7.4 on demand reduction. The role that technology and a digital economy played in buffering against impacts on the food system became apparent during the months of the pandemic. The information provided by these just-in-time systems helped to strike the necessary balance between a food system architecture obsessed with efficiency and one that helped respond to local social and economic needs.

IIASA and ISC recognize the need to continue the work on identifying the "Transformations Within Reach" and to support this with robust scientific systems analysis. That will remain a major goal. The pandemic still has many more months to run before it can be said to be "over." During this period, the innovations, structural modifications, and lifestyle changes being witnessed today will continue to take hold. In other words, the context will be ripe for wide-ranging transformations, but only if the enabling frameworks are carefully crafted in the transparent, participatory, and fair manner that constitutes good governance.

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Annex: Summary of Thematic Reports

Annex 1. Enhancing Governance for Sustainability

The COVID-19 crisis has illustrated the value of, and need for, effective governance structures that foster cooperation and collaboration at different levels. As the crisis evolves, it is becoming increasingly evident that enhancing such governance arrangements is an important leverage point for the achievement of sustainability transformations going forward.

The "Enhancing Governance for Sustainability" report of the IIASA–ISC Initiative, "Pathways to a Sustainable and Resilient World" studies and synthesizes emerging lessons from the governance of COVID-19 across scales and identifies options and recommendations for harnessing these lessons with a view to enhancing governance for sustainability overall. See Figure A1.

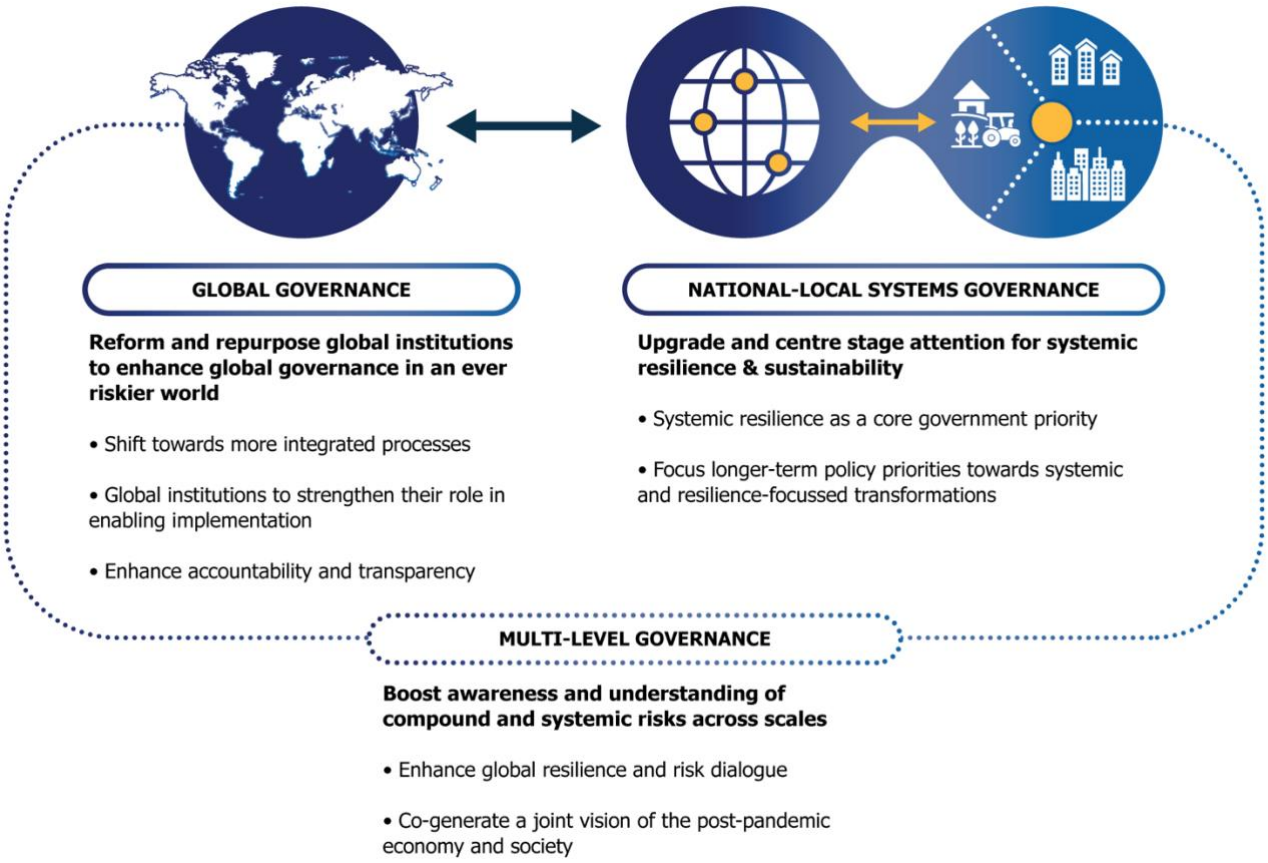

Figure A1. Options and recommendations for enhancing governance for sustainability across scales

Options and recommendations for enhancing governance for sustainability are differentiated by levels of governance: global, national–local systems, and multilevel governance. Among suggestions for the global level is to harness the leadership of sustainability champions to support reforms toward more integrated, accountable, and transparent global governance in an ever-riskier world. At national–local levels, options and recommendations encompass the need to put systemic resilience center-stage and to further mainstream transparency and accountability, including in the governance of recovery initiatives already under way across the world. Multi-level governance, as the link between global and national–local levels, could benefit from

strengthened awareness of compound and systemic risk; scaling up toward a global resilience dialogue and a joint vision of a more sustainable, resilient post-pandemic economy and society are suggested to achieve this awareness.

Annex 2. Strengthening Science Systems

Science has moved to center stage in the continuing COVID-19 crisis. Science has been called upon to provide solutions across a very broad front—not only to the immediate challenges to health but also to the many social and economic challenges posed by the pandemic. The report on strengthening science systems begins with an assessment of how science contributed to addressing the challenges posed by the COVID-19 pandemic and how, in turn, the challenges posed by the COVID-19 pandemic impacted on science.

Based on this assessment of science systems in relation to the pandemic, three axes of improvement are required in order for the science system to respond more effectively to future global crises: reacting more rapidly, *increased agility;* enhancing the quality of output, *greater reliability*; linking more effectively to policy and to the public, *increased relevance*. The objective is a simultaneous improvement in all three axes, thereby moving science systems to a new frontier.

A number of challenges and constraints that science systems have had to confront in the pandemic are identified. To confront these and ensure improvement across a broad front, the report puts forward a large number of recommendations, grouped under five interrelated major transformative changes as identified in Figure A2 below.

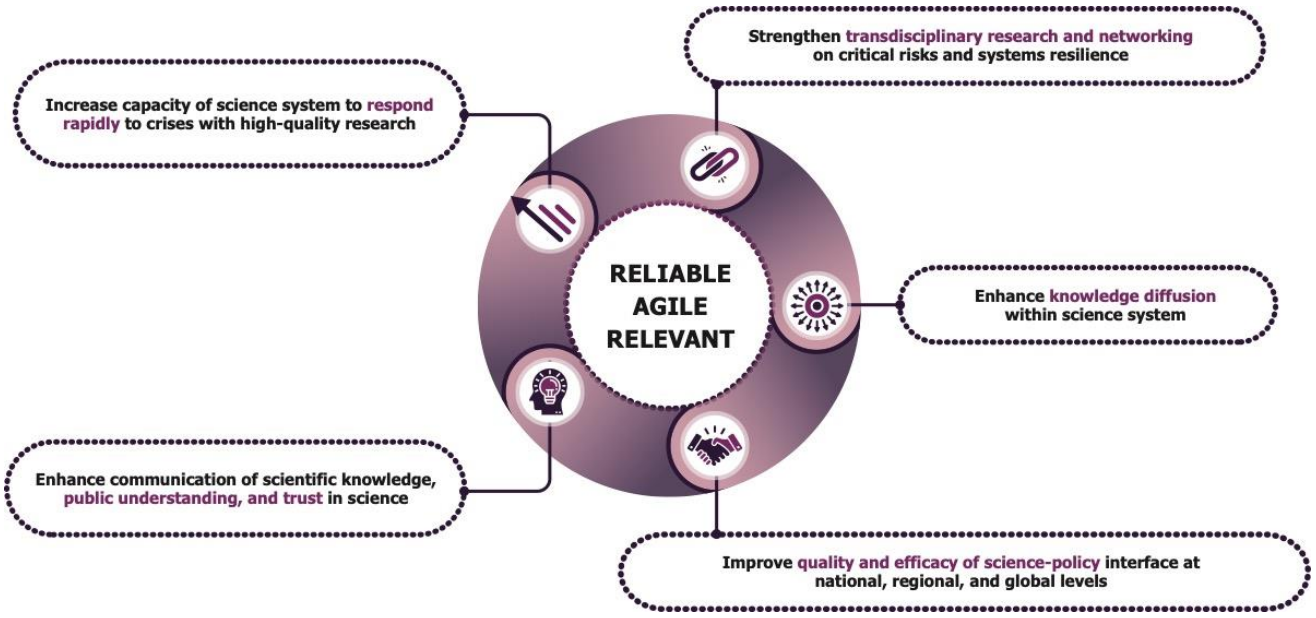

Figure A2. Five interrelated transformative changes

These recommendations are addressed to all the stakeholder groups represented in the consultation process: scientists and science institutions in particular, but also science journalists and publishers, funders, the private sector, and policymakers at both national and international levels.

Annex 3. Rethinking Energy Solutions

The energy sector has been impacted by the COVID-19 in different ways. Energy demand has decreased due to the reduction in economic activities and traveling, resulting in unprecedented low oil prices in global markets. Disruptions have occurred in the supply chain of energy technologies. Investments in low-carbon energy have declined. Dramatic lifestyle changes induced by lockdowns and containment measures have created new mechanisms of working, business, and education, for example, through digitalized solutions, some of which may survive the pandemic itself. The COVID-19 crisis has also increased global inequality in access to basic energy services, with the most devastating impacts falling on vulnerable groups and the urban poor. These groups are having difficulty maintaining a decent quality of life and accommodating new energy and services needed for home schooling and running an office at home, with their small businesses and unsecure jobs being lost too. See Figure A3.

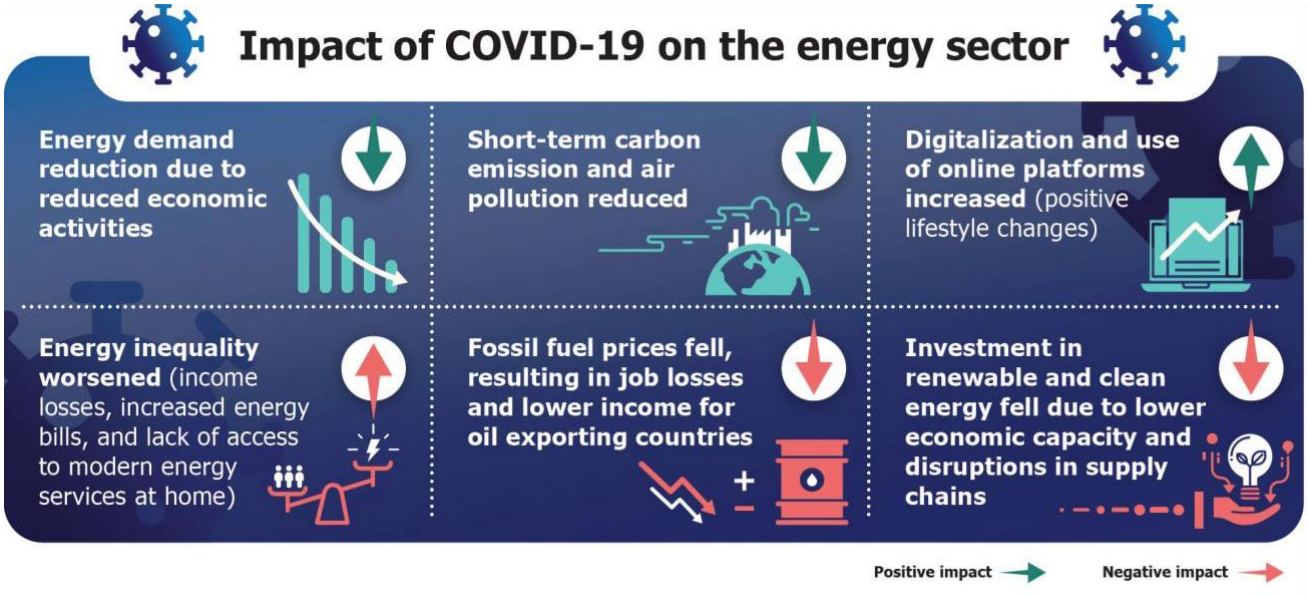

Figure A3. The impact of Covid-19 pandemic on the energy sector

The long-term impacts of the pandemic are still uncertain, not just on the energy sector, but on human well-being, the economy, and the environment. This raises questions and concerns as to how the post-COVID-19 recovery will advance or undermine efforts to achieve the Sustainable Development Goals (SDGs) and meet the Paris Agreement pledges on climate change. Decisions made today will either accelerate the transition toward a more sustainable and resilient energy system or slow it down.

"Rethinking Energy Solutions" puts forward three key policy interventions that could help decision makers lay out a pathway to a sustainable, resilient, people-centered, equitable, and climate-friendly future. Cities and urban spaces are identified as key areas that need to be rethought if there is to be a positive effect on energy consumption, livability, and resilience. This report also identified that gaining an understanding of how the pandemic has influenced individual behavior, lifestyles, consumer choices, and social practices in relation to energy, mobility, and sustainable consumption in the longer term will be a key part of the "new normal." Science can provide a valuable contribution to identifying and designing sound energy policy options in the short, medium, and long term in the face of uncertainty.

Decarbonizing economy and redirecting excessive consumption to sufficiency through a circular and sharing economy is one of the pillars of our findings. Last but not the least, different institutional, societal, and economic potentials are discussed in terms of mobilizing them to advance decentralized, efficient, and renewable energy systems.

Annex 4. Resilient Food Systems

The centrality of food systems to meeting the Sustainable Development Goals and the objectives of the Paris Agreement has long been recognized. COVID-19 is creating new realities for development, undermining long-term development gains toward poverty alleviation and universal food security, as well as revealing the vulnerabilities and interdependencies embedded in current food systems.

The report begins with an overview of food systems, the multiple social, economic, and environmental challenges with which they are confronted, and the case for transformation. It then discusses the impacts of the pandemic before exploring the opportunities and challenges for harnessing the recovery to build more resilient, equitable, and sustainable food systems, which will require ensuring that recovery from one crisis is not traded off against preparedness for another. A set of focal areas for action are identified centered on empowering a systemic shift toward greater resilience and equity; integrating human and planetary health concerns; and securing innovation, technology diffusion, and up-scaling of sustainable practices. The role of international cooperation and partnerships and the science–policy interface is explored in this context.

The report argues in particular that the emphasis on efficiency, which has been driving to a large part the evolution of food systems, needs to be complemented by a greater emphasis on resilience and equity concerns. As illustrated by the pandemic, this entails expanding the scope and reach of social safety nets and protection schemes. It also includes assessing and, where necessary, adjusting the capacity of supply chains and trade to absorb and adapt to a multitude of risks.

The integration of human and planetary health concerns represents an important aspect of building resilient food systems. Environmental degradation, habitat fragmentation, wildlife trade, and the homogenization of agricultural activities have facilitated the rise of zoonotic diseases. Alongside biodiversity loss and climate change, COVID-19 further highlights the entanglement of human and natural systems. In addition to meeting basic human needs and advancing human welfare, the food system needs to be recognized in its critical role of managing the risk of pandemics and protecting Earth's life support system.

The report presents arguments for the adoption of ambitious targets for biodiversity conservation and protection of critical natural resources alongside strengthened enforcement mechanisms and incentive structures for environmental stewardship. Dietary shifts can help address key health concerns like childhood stunting, obesity, and non-communicable diseases while also reducing pressure on natural resources. The affordability of healthy and environmentally sustainable diets, which remains a challenge for large parts of the world population, needs to be addressed.

To prepare food systems for the present and future challenges, it is imperative to ensure that innovation carries on during the recovery process. The pandemic has illustrated the potential of technology in buffering against some of the impacts on food systems, but there is concern that different fiscal capabilities will further widen the technology gap between countries. Ensuring the food security of a growing world population while addressing global environmental change, will require food productivity to be improved. The suitability of under-

utilized crop varieties to improve food security in marginal environments needs to be considered, as do advances in livestock productivity. Technical and financial assistance to expand access to viable sustainable land and natural resource management practices need to be ensured. The IIASA–ISC consultations underline the importance of strengthening the endogenous research capacities in countries to enable more diverse and context-specific solutions, while taking into account global sustainability constraints. Science can also play a critical role in evaluating the impacts of innovations across food systems, helping to identify pathways for managing potential trade-offs and synergies between economic, social, and environmental goals; international collaboration and solidarity and partnerships working across disciplinary and political boundaries are also required to enable the collective knowledge and resource transfer for building resilient food systems.

ABOUT THE IIASA-ISC CONSULTATIVE SCIENCE PLATFORM:

Transformations within reach: Pathways to a sustainable and resilient world

Starting in May 2020, a partnership between the International Institute for Applied Systems Analysis (IIASA) and the International Science Council (ISC) has drawn on the combined strengths and expertise of the two organizations to define and design sustainability pathways that will enable building-back a more sustainable post COVID-19 world. The platform has engaged a unique set of transdisciplinary global thought leaders on four themes:

- Governance for sustainability
- Strengthening science systems
- Resilient food systems
- Sustainable energy

The series of publications, Transformations within reach: Pathways to a sustainable and resilient world, presents the results and recommendations of the platform on the design of sustainable pathways and policy choices during the COVID-19 recovery period.

The platform is informed and supported by an advisory board under the patronage of the former Secretary-General of the United Nations H.E. Ban Ki-moon.

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The vision of the ISC is to advance science as a global public good. Scientific knowledge, data and expertise must be universally accessible and their benefits universally shared. The practice of science must be inclusive and equitable, as should opportunities for scientific education and capacity development. ISC is a non-governmental organization with a unique global membership that brings together 40 international scientific Unions and Associations and over 140 national and regional scientific organizations including Academies and Research Councils.

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