SDG ACTION

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SUSTAINABLE DEVELOPMENT GOALS

© UN in Papua New Guinea

Healing people and planet

The pandemic makes the SDGs even more relevant, even more critical to ensure that we leave no one behind

By Amina J. Mohammed, Deputy Secretary-General, United Nations; Chair, United Nations Sustainable Development Group

COVID-19 has shaken the pillars of our world with all-encompassing disruption: societies, economies, and people are reeling. According to United Nations estimates, the pandemic has pushed 114.4 million people into extreme poverty, and we are forecasting sharp declines in the UN Human Development Index.

While rich countries have eased some of the pain by spending more than 10% of gross domestic product on rescue packages and other measures, emerging economies and the poorest countries have lower budgets and little fiscal space, and face liquidity shortfalls that constrain their responses.

The crisis has also highlighted and exacerbated pre-existing inequalities across the world. This is particularly the case for gender equality, where we risk losing a generation of gains.

Women have been pushed out of the labor force and into poverty in higher numbers, and are absorbing the burden of skyrocketing care responsibilities alongside the economic and health consequences. All of this has also been accompanied by an alarming increase in male violence against women and girls.

The pandemic has hit the most vulnerable hardest, including:

- people caught up in conflicts or disasters
- children and youth
- persons with disabilities
- people lacking social protection
- those in the informal sector

It has caused immense psychological suffering for millions with limited mental health services. And it has exposed the perils of encroachment on wild habitats,

◂ Members of a community in Hoiebia, Papua New Guinea, meet with Amina J. Mohammed, UN Deputy Secretary-General. The community is home to families displaced by disasters and conflict

which are the primary pathways for emerging infectious diseases. With biodiversity declining and climate change intensifying, the current crisis must also be a wake-up call to transform our relationship with nature.

A new urgency

The upheaval has underscored the urgency of the SDGs. Indeed, the 2030 Agenda for Sustainable Development is designed to address the very fragilities and shortcomings that the pandemic has exposed. This means that COVID-19 recovery is an opportunity to invest in the SDGs and to find a path that:

- promotes public health
- revitalizes economies
- safeguards the environment
- closes the digital divide
- brings people in from the margins
- builds long-term resilience, sustainability, opportunity, and peace

But doing so requires bold policy choices. We need to put the SDGs, women's full inclusion, and the aims of the Paris Agreement on climate change at the heart of the pandemic recovery. We need to make sure that countries have the resources to continue responding to the pandemic and to recover better, including through debt relief. And we need to ensure the equitable distribution of vaccines.

Raising ambition

It will be critical to raise ambition on three major fronts: poverty, gender equality, and climate action.

Ending poverty and ensuring equality will require a major expansion of social protection systems and a reimagining of education, health, jobs, and financial systems. Tackling gender equality will require funding and political will to achieve equal participation in all realms of decision-making, advance economic inclusion, invest in the care economy, and enact laws and national emergency plans that prevent violence by men against women and girls. We have seen in the last year the effectiveness of women's leadership in achieving better outcomes for all, and so can build on those successes.

Responding to the climate emergency will require:

- halving emissions by 2030 (compared with 1990 levels)
- ending environmentally harmful subsidies and the building of new coal-fired power plants
- investing in renewable energy
- shifting to sustainable food systems
- taking advantage of nature-based solutions
- ensuring just transitions
- achieving net-zero emissions by the middle of the century

Beyond the benefits for the health of people and planet, the transition to net zero will bring substantial new opportunities for employment.

> ***"Ending poverty and ensuring equality will require a major expansion of social protection systems and a reimagining of education, health, jobs, and financial systems***

Finance and cooperation

Financing will be crucial and developing countries will need solid packages of support. This is a central focus of the initiative launched by the Secretary-General, together with the Prime Ministers of Canada and Jamaica, on Financing for Development in the Era of COVID-19 and Beyond. The entire financial system has started to shift, led by champions such as the Net-Zero Asset Owners Alliance, representing USD 5.7 trillion of assets under management.

We also need a reinvigorated multilateralism: networked to promote closer cooperation among international organizations, and inclusive to bring in civil society, the private sector, local authorities, and other sectors and stakeholders.

The summits, high-level meetings, and other key moments this year provide many opportunities to come together in the face of today's multiple emergencies and heal people and planet. These include:

- COP26, the United Nations climate change conference in Glasgow in November
- COP15 on Biodiversity, aimed at adopting a post-2020 global biodiversity framework to halt the extinction crisis
- the UN Food Systems Summit
- the Generation Equality Forum
- gatherings on sustainable transport and energy

Pummeled as we have been by the pandemic, we can still draw strength from the human spirit displayed so widely and movingly across these challenging months: the heroics of essential workers, the collaboration of scientists to produce vaccines in record time, the passion of young climate activists, and the engagement of those calling for gender equality and racial justice.

The appetite for change is palpable. The 2030 Agenda provides the guiding light towards a safer, more equitable and peaceful world for today's and future generations. The decisions taken over the next few months and years will have enormous impact on where we will be by 2030.

The United Nations will continue to work actively with all partners to make the most of this pivotal moment and to propel the world into a transformative Decade of Action to deliver the SDGs. ■

A global roadmap for recovery

The SDGs provide a ready-made plan for tackling humankind's two greatest threats: COVID-19 and climate change. The solutions are within our reach

By Jeffrey D. Sachs, Director, Center for Sustainable Development, Columbia University; President, UN Sustainable Development Solutions Network

Kudos to the authors of the SDG Action Report for helping us to see the way forward. The world was complicated enough before COVID-19, but became immeasurably more complicated with the pandemic. How can we think about bold global goals when we are in the midst of battle against a virus?

The answer comes in two parts. First, the path to success in fighting COVID-19 has much in common with the path to success in achieving the Sustainable Development Goals and objectives of the Paris Climate Agreement. Second, the SDGs and Paris Agreement give a global roadmap for recovery, enabling us to rebound quickly and effectively from the pandemic.

Whether we are fighting a pandemic, or climate change, or loss of biodiversity, or the scourges of extreme poverty, we face a similar set of challenges of global scale.

To succeed against COVID-19, we must cooperate globally, since the virus and its new variants do not stop at national borders. We need to mobilize innovations, such as new vaccines and therapeutics. We need social justice, so that we don't leave the poor to suffer while the rich are able to protect themselves. We need forward planning, for example to achieve comprehensive vaccine coverage in the coming months. We need financial resources, mobilized to face humanitarian crises, buy and distribute vaccines, and propel economic recovery.

Yet these systematic prerequisites for ending the pandemic – global cooperation, technological innovation, commitment to social justice, long-term planning, and financial mobilization – are the same prerequisites for success in our other global challenges. Climate change too can be faced only with deep global cooperation, innovative energy technologies, commitments to a just transition, planning to 2050, and the mobilization of finances needed for the large-scale energy transformation in all parts of the world.

We can say, in short, that the challenges of sustainable development require a new kind of thinking and a new kind of policy-making. The essays in this volume make this very clear. Our problems today – whether from disease, climate change, loss of biodiversity, gender discrimination, poverty traps, or others – cut across society and the economy, engage the entire world, and require long-term global and national strategies for transformation.

There are no easy and pat solutions. The "magic of the marketplace" won't solve our problems. Nor can any single sector or innovation. Sustainable development requires a holistic approach to problem-solving, one that simultaneously addresses economic, social, and environmental objectives, that calls for unprecedented cooperation across nations, and collaboration across stakeholders, including government, business, academia and civil society.

This kind of holistic and ethical approach may seem far-fetched. After all, isn't conflict between nations inevitable? Aren't businesses committed to profits ahead of societal interests? Aren't the rich and the poor condemned to social conflict? On some days it seems that the answer is yes to all of these questions, but the important essays in this volume remind us otherwise. Cooperation is possible, and human needs can prevail over vested interests, greed, and the pursuit of power.

Take the case of climate change, discussed by several of the writers. First, the news is good regarding innovation. Zero-carbon energy technologies, ranging from photovoltaics to electric vehicles, are improving dramatically. We can see the technological pathway to a net-zero emissions economy by mid-century.

Second, there is a growing movement of global cooperation around the shared vision of reaching net-zero emissions by mid-century. The world's major economies are signing on to the vision of rapid, global-scale decarbonization.

Third, even though the mobilization of official financing for climate action has been woefully slow up until now, the world is finally beginning to focus attention on the trillions of dollars of new renewable energy financing that will be needed, and on the role of the multilateral financial institutions such as the World Bank and regional development banks that can play a crucial role in that financial mobilization.

Fourth, the major stakeholders across society are finally coalescing around the climate realities. Young people have been in the lead, forcing the older generation to abandon the delays and cynicism that have blocked effective action for so many years. Businesses are coming around too, and when the managers are too slow, activist shareholders are increasingly jumping into action.

▲ A Roma mother and baby attend a health check at a pediatric clinic in Serbia. The COVID-19 pandemic has accentuated and highlighted the inequalities experienced by minority groups

In our thinking at the UN Sustainable Development Solutions Network, the SDGs and the Paris Agreement require six major transformations across global society. These are spelled out in the Sustainable Development Report 2021. The transformations include: quality education for all; healthcare and wellbeing for all; clean energy and industry; sustainable agriculture and land use; sustainable cities; and digital transformation with universal access to digital services.

The essays in this volume touch on all of these critical transformations. They show, in fact, the feasibility of these transformations. We have impressive new technologies, rising global awareness, and ample potential financing if we direct our resources properly. In short, we have the technological and financial tools that we need for sustainable development, if we adopt the proper mindset and policy strategies needed for success.

We have two major tasks in the year ahead. The first, most urgently and obviously, is to win the battle over COVID-19. There have been four million confirmed COVID-19 deaths by mid-2021 (and many more deaths from the pandemic not properly counted). This scourge must be brought to a rapid end. Our most important task in the coming months is to ensure universal vaccine coverage, while maintaining the other needed public health measures and precautions.

The second challenge is to secure the path of recovery, not merely to return to the pre-COVID status quo, but to launch a new global trajectory towards sustainable development, including success in the SDGs and the Paris Climate Agreement. Several important global summits this year will take on the great challenges of sustainable food systems, protection of biodiversity, and climate change. We will have the key occasions, therefore, to win global assent on a common framework for action.

As an economist, I will conclude this introduction with a call to action on financing for sustainable development. We are a very rich world beset by poverty and self-inflicted environmental destruction.

The actions called for in this volume are not expensive, especially compared with the costs of inaction. The end of poverty is within our reach, and a safe environment is similarly within our grasp. By pursuing the wise approaches recommended throughout this volume, and investing our resources in those solutions, we can indeed achieve the future we want. ■

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Recovery built on the SDGs

The SDGs provide the only possible path to lead us from current crises to a future of long-term survival for our planet and inhabitants

By Phoebe Koundouri, Director, ReSEES Research Laboratory, Athens University of Economics and Business; Co-chair, UN Sustainable Development Solutions Network (SDSN) Europe

We currently face three simultaneous global "tsunamis": the COVID-19 pandemic, the economic crisis that derives from the pandemic, and the mother of all crises, the climate crisis. To respond to the health crisis, we take

◂ Park Biblioteca degli Alberi (Library of Trees) with the towers of Bosco Verticale (Vertical Forest) in Milan, Italy. The European Union has instituted NextGenerationEU, a €750 billion temporary recovery instrument to help repair the immediate economic and social damage from the COVID-19 pandemic. Its aims and substance align with the EU's net-zero plan (the European Green Deal) and the SDGs

social distancing measures. Biomedical research, meanwhile, has enabled the production of relevant vaccines, which provide hope for containing the pandemic.

To respond to the economic crisis, both short and medium-term measures have been employed. Short-term measures try to avoid the pandemic turning into a major economic and financial disaster that will long outlast the health crisis. Currently, these measures include ensuring that:

- the workforce remains employed even if quarantined
- public and private institutions have the financial support to help vulnerable citizen groups
- small and medium-sized enterprises are safeguarded against bankruptcy
- policies are enacted to support the financial system as non-performing loans mount

Medium and long-term responses focus on developing fiscal packages that will finance the recovery, comparable to the crisis-related loss of gross domestic product (GDP). These fiscal packages will have to be financed by national debt. As such, they will be paid for by future generations.

The current generation therefore has a moral responsibility to "build forward better" in a way that considers the prosperity of future generations. That means restarting our socio-economic systems and their interaction with natural ecosystems in a sustainable way.

One major challenge for a sustainable recovery is the urgency of tackling the climate crisis, to limit global warming to 1.5°C, beyond which the risk of extreme weather events and poverty for hundreds of millions of people will significantly increase.

Currently, there is no country in the world that is not experiencing the drastic effects of climate change. The annual average economic losses from climate-related disasters are in the hundreds of billions of dollars. Between 1998 and 2017, 1.3 million people were killed and 4.4 billion injured by climate-related events.

As indicated in the UNEP Emissions Gap Report 2020, current nationally determined contributions (NDCs) for climate change mitigation are inadequate to achieve the Paris goals, and would lead to a temperature increase of at least 3°C by the end of the century. The net-zero emissions goals recently announced in Europe, China, and other major economies could reduce this increase by about 0.5°C.

> ***// This crisis calls for transformative public investments. These must shape a sustainable, resilient, job-based, socially inclusive, green, and digital transition***

The tools to enact change

The main question we need to answer is: how can countries recover in a way that simultaneously responds to this unprecedented triple crisis? The answer is that the relevant blueprint already exists. It consists of the Sustainable Development Goals (SDGs) and the Paris Agreement on climate change. Both these frameworks call for deep transformations in every country, requiring complementary actions by governments, civil society, science, and business.

An excellent framework for realizing the 17 SDGs is the Six Transformations introduced by UN SDSN, which provide modular building blocks of SDG achievement. The Six Transformations are:

- education, gender, and inequality
- health, well-being, and demography
- energy decarbonization and sustainable industry
- sustainable food, land, water, oceans
- sustainable cities and communities
- digital revolution for sustainable development

Each transformation respects the strong interdependencies across the 17 SDGs. The transformations identify priority investments and regulatory challenges, calling for actions by well-defined parts of government, business, and civil society.

Indeed, beyond the fiscal stimuli that are expected to boost aggregate demand, this crisis calls for transformative public investments. These must shape a sustainable, resilient, job-based, socially inclusive, green, and digital transition, and must also leverage private-sector investment. The message that we must get across to all relevant stakeholders, politicians, policymakers, businesses, financial institutions, and civil society is that, in addition to the moral case, there is an economic case for a sustainable and resilient recovery. Various simulations of the effect of green recovery plans worldwide confirm that a green economic stimulus is more growth-enhancing than a "return-to-normal" stimulus. The latter would merely boost current, unsustainable consumption and production patterns.

In the 2021 statement of the Lancet COVID-19 Commission Task Force on Green Recovery, we argue that the following policy-financial-technology interactions will provide the required impetus to transform the recovery into a green and digital future:

- Recent political commitments to achieve climate neutrality by around mid-century in Europe, China and other major economies.

- Strategies based on environmental, social, and corporate governance (ESG) and investing in sustainability now account for over one third of global assets under management and are likely to be the majority of global assets in the coming years, which changes the direction of global capital flows.
- Renewable energy sources, circular economy production and consumption practices, and nature-based solutions, offering significant financial private and public benefits, major reductions in greenhouse gas emissions footprint, coupled with numerous health and social benefits.

European Green Deal

The European Green Deal (EGD) is an interesting case study for an SDG-based transformative transition, as it provides the right level of ambition and direction for the long-run vision of the joint implementation of the SDGs and the Paris Agreement. UN SDSN has showcased work around the recovery in Europe in a recent report. The main message from the report is that the SDGs, the EGD and the NextGenerationEU recovery instrument (worth €750 billion, in addition to European Multiannual Financial Framework, and focused on a green, digital, inclusive recovery) are consistent policies, with the same targets and content.

The SDSN report also discusses the actual transformation pathways that can mobilize the European transformation and are also relevant for the global sustainable recovery. In the report we argue that the EGD and the European Recovery and Resilience Facility (the main part of NextGenerationEU) should be conceived with a systems approach. This means simultaneously addressing multiple objectives and promoting policy instruments and technological solutions that can be used across the various sectors of the economy.

Within this systems approach, it is important to consider the many complementarities for managing the complexity of the energy system:

- variable renewable energy sources
- zero-carbon technologies
- public and private investments
- natural and engineered systems
- mitigation and adaptation
- centralized and decentralized solutions
- actions and strategies
- research and development activities promoted by research institutions and academia and funded by the private or public sector

Moreover, EU countries should have detailed plans exploring all options for decarbonizing their economies, and the associated costs. These should be reflected in their national energy and climate plans, and their Paris Agreement NDCs. EU countries need broad policy frameworks that contain:

- clear goals
- technology roadmaps
- regulatory assignments to stakeholders
- strong systems of deliberation
- strategies to raise public awareness
- mechanisms for reporting on outcomes
- a holistic approach
- a focus on energy efficiency and energy saving on the demand side, limiting worldwide energy demand without compromising economic development and energy access

Since the 1980s, governments in Europe were asked to intervene only for the purpose of fixing market failures. Now governments are asked to make significant long-term investments to support rapid recovery from the coronavirus shock. Businesses do not invest unless they see an opportunity for growth, so turning mitigation into opportunities for investment and innovation is key.

Sustainable innovation requires patient, long-term, strategic finance. This demands a significant entrepreneurial role for the state to provide the required patience. At the macro level, Europe needs to re-conceptualize financial stability and the "mission" of central banks to include climate and environmental degradation risks.

The European Investment Bank (EIB) and the European Investment Fund have the expertise and scale to set the direction in deploying equity-type financial instruments complementary to loans and guarantees. At the meso level, national public investment organizations provide positive sources of long-term patient finance, which support sustainable investing. At the micro level, companies need to understand that those which switch towards sustainable or green practices soonest will be the most competitive, most innovative, and most successful over time.

An important mobilizer for the European sustainability transition is the EU taxonomy, launched in 2019. This is a classification system that defines sustainable economic activities, and as such creates a common language for investors and lenders. The EU taxonomy can scale up private and public investments to finance the transition to a climate-neutral and green economy. The challenge is to connect the taxonomy with financial instruments (green or transition bonds, green loans, and so on) and business reporting.

Currently, corporate leaders and investors deal with two separate and disconnected business reporting systems: one for financial results and the other for ESG performance. What are needed are hybrid metrics, allowing companies to report both their financial profits and their footprint on the environment and the society. Such metrics will enable a new frontier for sustainable valuation.

Another crucial dimension of the sustainability transition, explicitly addressed by both the SDGs and the EGD, is the importance of a just and inclusive transition. For this, job creation multipliers are crucial. Investments in line with the EGD can lead to approximately one million new jobs in energy and energy-related sectors in Europe by 2030. Most new jobs created in Europe will be in highly

skilled positions, requiring substantial training. A third of new jobs will require moderate retraining (transitioning workers within the same industry or occupation). Very few opportunities in Europe, however, will be for low-skilled jobs. Moreover, the distributional effects of key EU climate policies should be considered. Measures to limit the regressive effects of combined mitigation policy options should ensure more equality, increase GDP and employment, and have a progressive effect in all EU regions.

The energy transition must be inclusive and fair for all people in Europe, while EGD and recovery and resilience plans should be oriented to reduce income inequalities. Genuine stakeholder participation can ensure democratic oversight, as well as directing public funds towards the most socially desirable uses. Open-source models, transparency, and stakeholder engagement are crucial for supporting the green and digital stimulus measures enacted by governments and society.

As in all crises, timing is critical. The post-pandemic fiscal stimulus is larger than anything we've seen before. Policymakers need guidance, and fast, to steer between health protection, economic relief, and climate resilience. The potential of sector-specific policies and reforms to green and digitize the economy could be assessed through a comprehensive list of sustainability and resilience criteria, explicitly linked with the SDGs.

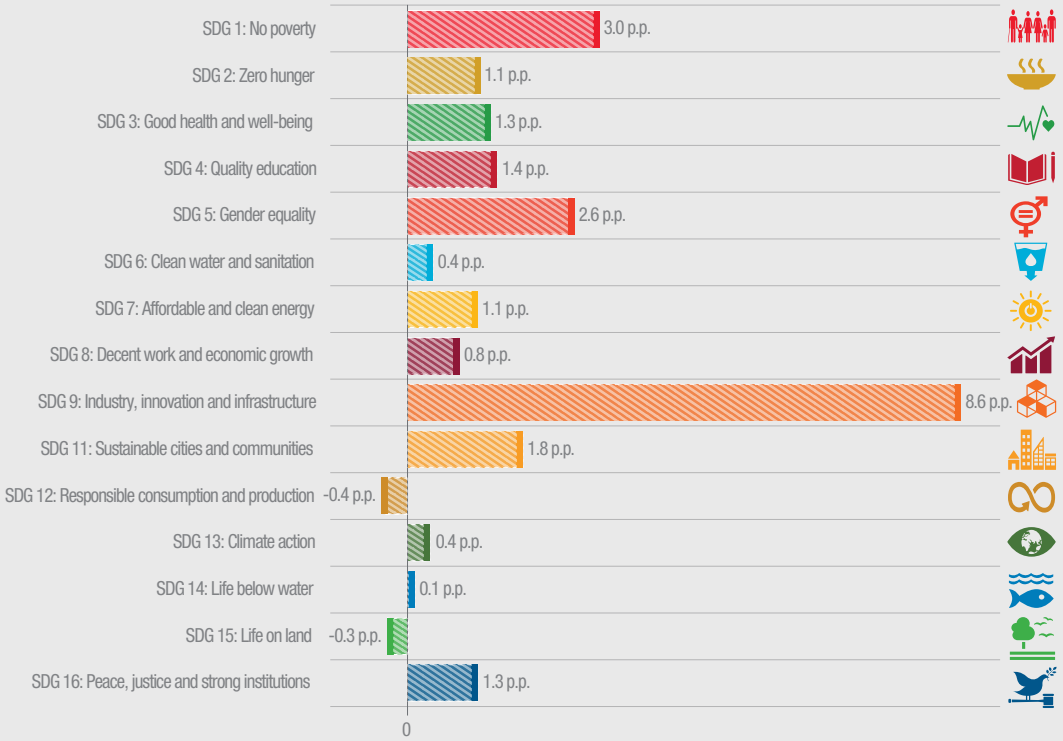
A global challenge

Looking at the global picture, financial resources and commitments for a post-COVID-19 recovery are so far largely insufficient for a green recovery, including in most G20 countries. Low-income countries and some emerging markets urgently need support to address the immediate consequences of the pandemic, but also to build back in a way that is more sustainable, inclusive, and resilient.

As a response, the International Monetary Fund (IMF) and World Bank, including major economies like the US, the EU, China, and other G20 countries, have signaled their support for a new USD 650 billion special drawing rights allocation of IMF reserves. These will ensure that governments in low and middle-income countries have the means to combat the COVID-19 pandemic and start on the path of investment-led recovery.

Given that this help, together with the existing Recovery and Resilience Facility, will start being implemented around September 2021, the world's capacity for deploying the green and digital transformative transition to sustainability will certainly be tested in the next three years. ■

FIGURE 1: Progress in the world for each SDG since 2015 in percentage points



Note: Population-weighted averages. Insufficient data for SDG 10 (Reduced inequalities) and SDG 17 (Partnerships for the Goals).
Time series data for SDG 12 (Responsible consumption and production) is only based on the indicator "Electronic waste (kg/capita)."

Source: Sustainable Development Report 2021

Governance tested

The pandemic has painfully exposed many societies' inability to deal with crises. We must urgently innovate and democratize our governance structures if we're to thwart the existential threats facing humankind

By Adolf Kloke-Lesch,
Co-Chair, SDSN Europe

The challenge of achieving the Sustainable Development Goals (SDGs) puts the way in which we govern ourselves to the test. If we wanted to achieve the SDGs by 2030 by just using the governance structures of the pre-2015 world, we would end up in that world again, or even worse.

For several years, our domestic political systems and the global governance architecture have been struggling to respond effectively to people's changing needs and aspirations, as well as to present and future threats to our societies.

The COVID-19 pandemic has further laid bare the deficiencies of how our societies, as well as humanity as a whole, deal with common and collective problems.

◂ Demonstrators from several NGOs and unions call for a "true" law on climate at Place de la Republique in Paris, France

Why governance is ineffective

In many countries, politics and society are characterized by institutional, political, and ideological path dependencies, where practices continue based on historic preference.

The nature of entrenched vested interests and power elites also renders it difficult to adequately address challenges like the pandemic, climate change, or the fracturing of societies. Where political systems fail to respond to grievances, bring forward responsible leadership, or integrate heterogeneous values and norms among societal groups, populist movements and leaders can more easily exploit frustration, often exacerbating the underlying root causes.

On the other hand, we observe societal movements like Fridays For Future and Black Lives Matter, and democracy and human rights activism in all continents that call for solutions to these problems. In some places, they are increasingly met with the authoritarian arm of political systems, particularly in the wake of the pandemic.

Similarly, many features of the present global governance architecture hail from a time when our world looked different from today. Over the past decades we have seen major global shifts in demography, economics, and politics. These shifts, as well as today's urgent needs for collective action to safeguard the future of humanity, are not adequately mirrored in our global institutions.

It was a rare and historic achievement when in 2015 world leaders adopted the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change. However, the first five years of the implementation of both did not meet expectations. On the contrary, the rise of populist and nationalist counter-transformations, as well as the increase of geopolitical tensions, let multilateral, solution-oriented cooperation grind almost to a halt. The patchy international reaction to the pandemic has sadly been further proof of this.

The need for integrated, all-society, and all-humanity approaches to the great challenges of our times is at odds with two main features of today's domestic and global governance.

First is the separation and division of labor between policy fields at both the national and international level. This goes beyond ministries or international organizations and extends to business, academia, and society. The underlying rational of effective policymaking assumes that the sum of rational actions in each field yields the best societal or global impact.

Second is the narrow understanding of the role of the state and of the interaction between nation states. Here, the focus lies on regulating competition or balancing interests in the domestic and global markets as well as between nation states. Only at the nation-state level is this accompanied by public finance in the order of 30% to 50% of gross domestic product for investment in infrastructure and redistribution.

Again, the misguided assumption is that such an approach alone can best serve the interests of the individual economic actors or nation states, and therefore of society and humanity at large.

Transformations and new ways of working

The mismatch between our ambitions and the way we govern ourselves creates a dilemma. We need to change policies faster than we can responsibly change politics. The only way forward is disruptive incrementalism: looking for doable, smaller steps that can trigger bigger, transformative change.

In this respect, two interrelated approaches are proving both innovative and helpful templates for transformative governance. First, advancing the implementation of the 2030 Agenda

and the Paris Agreement by focusing on a limited set of key transformations. And, second, creating new ways for various actors to collaborate to drive these transformations forward.

The concept of SDG transformations was introduced by the global research initiative, The World in 2050 and developed further by the first Global Sustainable Development Report (GSDR) prepared for the UN in 2019. The GSDR identifies six systemic transformations (like food systems and nutrition patterns) and four transformational levers (like science and technology) (see Figure 1). This approach is mirrored in the European Green Deal (EGD), which designs a set of deeply transformative policies to implement the 2030 Agenda, and was also adopted by the recently updated German Sustainable Development Strategy.

The concept of SDG transformations both requires and allows for government, business, and civil society to work together in new ways across different sectors, to define goals and put integrated solutions into practice. These new ways of working are not meant to supplant the established structures of government and governance. Rather, they should complement, incentivize and reform the structures to deliver the necessary change.

More power to the people

The example of the German Coal Commission has shown that coordinated action for deep transformation can be agreed upon by the "antagonistic cooperation" of politics, business, and civil society.

In 2018, the Federal Government appointed and mandated the Coal Commission to develop a plan for the gradual phasing out of coal-fired power generation, which at the time accounted for one third of Germany's total power generation. The commission was composed of representatives from the energy sector, lignite mining regions, industry, environmental associations, trade unions, the scientific community, and the political parties that made up the government.

The agreement reached by the commission in 2019 may not satisfy everyone's ambitions, but without it the German energy transition would probably have ended up in a "governance gridlock." This and other examples have shown that such cooperation can be successful, from the international Extractive Industries Transparency Initiative (EITI) to municipal advisory boards for sustainable development. Another way is the introduction of randomly composed citizens' assemblies, such as the French Citizens' Convention on Climate. Whether through stakeholder commissions of antagonistic cooperation or citizens' assemblies, success hinges on how the legislative and executive branches of government deal with the output of these fora.

Transforming policy advice

Transformative politics needs transformative policy advice that breaks the boundaries of traditional disciplines. But most scientific advisory councils are mandated and peopled in ways that mirror government departmental structures. Councils of economic experts advise the ministries of finance and economy. Councils of natural scientists talk to the ministries for climate and the environment. If departmental policymakers and their respective epistemic communities are locked in self-referential discourse, solutions to problems that require cross-departmental cooperation are hard to find.

Since 2018, SDSN Germany and the Science Platform Sustainability 2030 have invited around 20 key advisory councils across government to the so-called Beirätedialog, an annual dialogue of the scientific councils. The aim is to foster interaction on policy advice and alignment with the 2030 Agenda. The dialogue has already led to some joint initiatives and changes in advisory work, but further success depends on the how government departments respond to this innovative, cross-cutting approach.

Build forward better by aligning economic governance with transformation

The urgent need to respond to the economic and social damage caused by the pandemic in a way consistent with the Global Goals requires an innovative re-alignment of economic governance mechanisms.

In Europe, the NextGenerationEU recovery instrument links solidarity and transformation in a continent-wide endeavor. It is innovative not only in the way it is financed but also in how it is governed. All member states both contribute to and benefit from the facility. They must all present recovery and resilience plans that will be assessed by the European Commission and approved by the European Council.

Although there are some procedural shortcomings with regard to the operational role of both the SDGs and the EGD, NextGenerationEU is the biggest chance ever to restart the EU's transformation towards sustainable development. For this to happen, the European Commission and the member states need to strongly link the design, assessment, implementation and monitoring of their recovery plans to the EGD and the SDGs. Furthermore, they must ensure that all stakeholders in sustainable development, from business to civil-society organizations to academia, are fully involved in the unfolding processes (including in the European Semester, the framework for the coordination of economic policies across the EU).

Universal cooperation

Achieving the SDGs requires an international cooperation architecture that is truly universal, one which encourages transformations in all countries, poorer and richer alike. As we are learning from both the pandemic and our collective sustainability challenges, there is no direct correlation between successful responses by countries and their income levels. All countries need

to live up to their responsibilities. All can contribute to solutions within and beyond their borders. All should have a voice in addressing challenges around the globe.

Achieving the Global Goals critically depends on implementation within the so-called developed countries as well as between them. The world is moving on from a time when a few countries had the solutions, money, and power, while others with the problems sat at the receiving end. The voluntary national reviews (VNRs) for the High-Level Political Forum on Sustainable Development and the nationally determined contributions (NDCs) under the Paris Agreement are welcome first innovative steps in the intergovernmental architecture that reflect the universality of both agendas. In contrast, most of today's international cooperation architecture is still trapped in the persistent path dependency of a North–South narrative that perceives cooperation as aid or charity limited to poorer countries.

Nonetheless, change is creeping in. In the fields of global health, environment, and climate, new cooperation instruments have been set up that follow innovative ways to mobilize, allocate, and govern funds. Among the contributors are some poorer nations. Allocation follows more the necessity to act than the neediness of places. Countries can be both contributing and implementing partners at the same time, can engage in reciprocal and circular learning, and come together in governance bodies in new and equitable forms.

These experiences demonstrate that a transition is already underway towards a new framework for financing social, economic, and environmental challenges in rich, poor, and middle-income countries. This new model of Global Public Investment is, in the words of former UN Development Programme Administrator Helen Clark, "our best bet for modernizing international public finance for the 21st century."

But do not be fooled: this transition will not come cheap. We will need significantly higher and more stable global funding to build forward better after the pandemic and achieve the Global Goals. Governing these funds differently is a precondition for doing so successfully. International cooperation for sustainable development needs to become universal, multimodal, mutual, and transformative if it wants to deliver change. ■

FIGURE 1: The six SDG Transformations underpinned by the principle of leaving no one behind, and circularity and decoupling

Source: Sachs J D, Schmidt-Traub G, Mazzucato M, Messner D, Nakicenovic N, Rockström J (2019). Nature Sustainability

Space-D: Innovation for the SDGs

Dubai Electricity and Water Authority is harnessing the power of space technology to transform its electricity and water networks

Water and electricity are vital for life and, as such, are enshrined in the Sustainable Development Goals (SDGs) under SDG 6 and 7 respectively. As the sole provider for electricity and water in the Emirate of Dubai, the Dubai Electricity and Water Authority (DEWA) has made a commitment to support and contribute to the SDGs. Its purpose is to provide globally leading sustainable, efficient, and reliable power and water services, and related innovative smart solutions.

Visionary leadership

The United Arab Emirates (UAE) has a human-centric vision, aiming to provide the best life for its people. UAE's Vision 2021 was launched by His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, five years before the SDGs.

The Vision had much common ground with the Goals: sustainable environment (SDGs 13, 14 and 15) and infrastructure (SDGs 6, 7, 9 and 11); world-class healthcare (SDG 3); first-rate education system (SDG 4); competitive knowledge economy (SDG 8); and safe, public, and fair judiciary (SDG 16). The country has now refined and built on that vision to map its development for the next five decades.

The UAE Centennial Plan 2071 is distinguished by its level of ambition: it aspires to position the country as a world leader in all these areas. This vision, combined with the efforts of organizations and citizens, is enabling the country to overcome challenges and achieve its ambitions.

▲ Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, launches DEWA's Space Program

As part of this drive to succeed, DEWA has made a commitment to support the country's goals for sustainable development by utilizing cutting-edge technologies and innovations. What could be more cutting edge or innovative than harnessing the power of space

technology to revolutionize the provision of power and water?

Space-D: DEWA's space program

In January 2021, His Highness Sheikh Mohammed bin Rashid Al Maktoum launched DEWA's space program: Space-D.

This ambitious initiative aims to build DEWA's capabilities and train Emirati professionals to use space technologies to enhance its electricity and water networks. Space-D will utilize Fourth Industrial Revolution technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), and Blockchain to exchange information using satellites and Earth observation technologies.

"DEWA's space program will contribute to enhancing the UAE's global competitiveness and strategic partnerships in the national space sector as well as paving the way for a new phase of Emirati capabilities in space exploration, technology, and related industries that will be used to strengthen electricity and water networks in Dubai," said Saeed Mohammed Al Tayer, Managing Director and Chief Executive Officer of DEWA.

Space-D will bring myriad benefits across DEWA's entire organization. It will increase the efficiency and effectiveness of DEWA's planning and operations, reducing costs and work-hours. It will enhance preventive maintenance at its generation, transmission, and distribution divisions, as well as at its smart grids and electric vehicle charging stations.

The new infrastructure will enhance DEWA's flexibility and agility in monitoring and managing electricity and water networks. It will enable more accurate and rapid assessments of weather and climate change impacts on energy supplies and infrastructure. And it has the potential to provide a backup support system for the network through satellite communications.

> ***"DEWA's space program will pave the way for a new phase of Emirati capabilities in space exploration, technology, and related industries that will be used to strengthen electricity and water networks in Dubai."***
>
> **Saeed Mohammed Al Tayer, Managing Director and CEO of DEWA**

Space-D's main satellite, equipped with the latest imaging and communication technologies, will be launched in conjunction with Expo 2020 Dubai, taking place between October 1, 2021 and March 31, 2022. A constellation of satellites, built by Emiratis at DEWA's Research and Development Centre at the Mohammed bin Rashid Al Maktoum Solar Park, will support the main satellite. A central ground station at the solar park will communicate with transmission stations across the electricity and water networks.

Digitizing power

Satellite connectivity, IoT sensors, and AI will transform the network from individual energy silos to fully digitally interconnected systems. It will see a revolution in automation, significantly reducing human-to-human coordination and supervision – with the ultimate objective to achieve full automation.

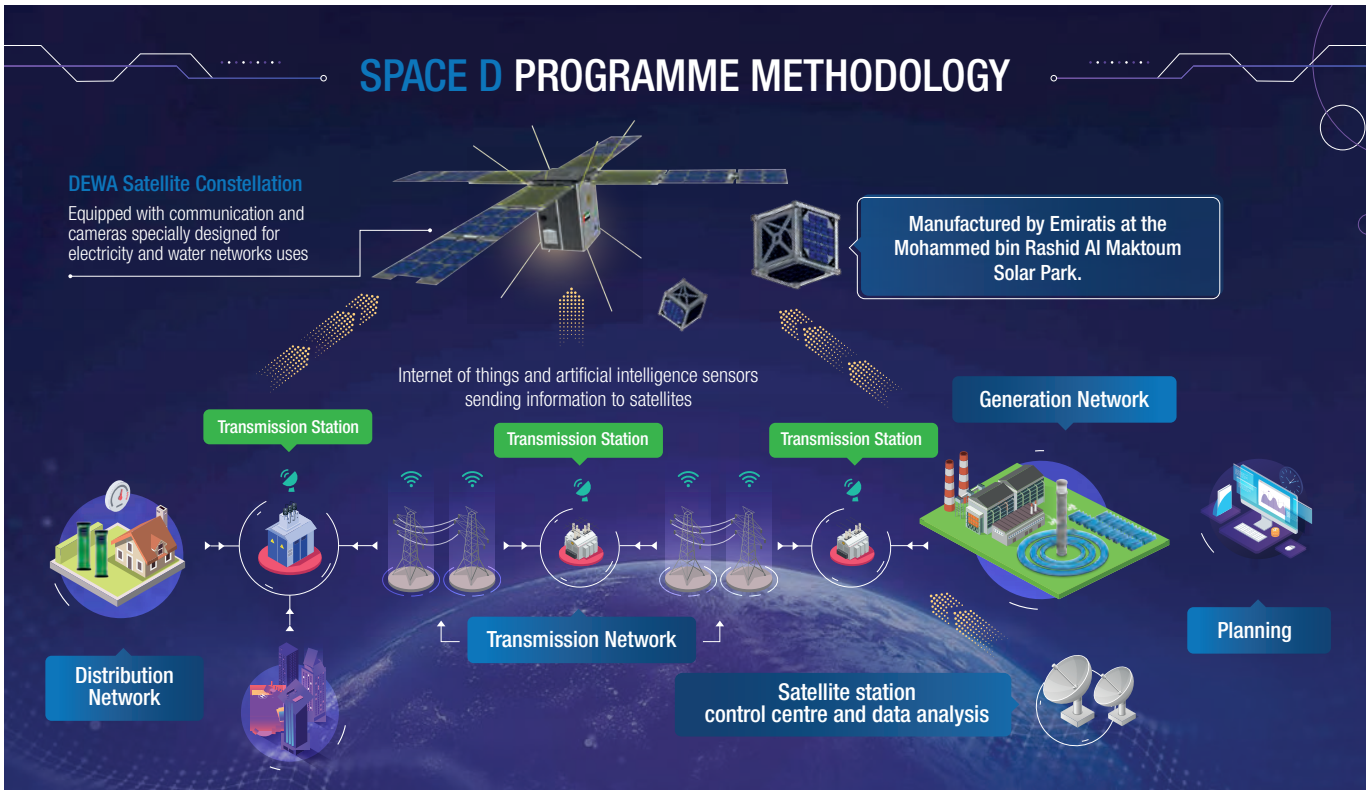
The benefits of this will be many and varied – from improved visibility across the system, to spotting anomalous activity more quickly, to making better use of assets, and minimizing labor costs.

Predictive maintenance and asset monitoring

Applying AI to the data captured from IoT sensors and satellite imagery will allow DEWA to more effectively monitor energy assets and predict when maintenance is needed to avoid failures such as power outages.

Space-D will enable real-time event and automated fault detection – everything from when overhead line poles tilt during abnormal weather, to when live conductors snap, vehicles collide, land slips, or overhead lines

► A visualization of DEWA's main Earth observation satellite. Built by Emiratis and launching in 2021, the satellite will be at the heart of a constellation of satellites



sag. The expected value and impact of this is a significant reduction in customer minutes lost and the number of technical complaints. As well as improving the reliability of the network, benefits will also include better power supply quality, reduced operational costs, and less reliance on manual labor, thanks to automating the inspection process.

Solar production forecasting

Space-D will enhance production and management of solar power. The satellite constellation's advanced imaging capabilities, coupled with on-the-ground weather stations and sky imagers, will enable DEWA to develop AI algorithms and models to forecast photovoltaic (PV) energy production for the coming hours.

This will mean better regulation and power scheduling in both the distribution and transmission grids, and being better able to assess fluctuations and risks of intermittence.

This in turn will generate a range of improvements in system stability and efficiency, electric power balance, reactive power compensation, frequency response, as well as minimizing grid overload.

Bigger picture

Through innovation and sound scientific planning, DEWA seeks to make its contribution to the UAE achieving its centennial ambitions in 2071. Space-D will be an important part of that.

The Space-D program supports the UAE's National Space Strategy 2030, which aims to realize the leadership's vision by using space sciences, technologies, applications, and services to enhance the country's development. Space-D also supports the Dubai Clean Energy Strategy's target of obtaining 75% of Dubai's total power capacity from clean energy sources by 2050.

Supporting the SDGs

Since 2016, DEWA has made a decisive effort to systematically explore how it can increase its alignment to the SDGs and be better positioned to contribute to their effective delivery.

DEWA has aligned its strategies and operations with the SDGs by acknowledging and affirming the SDGs' importance, identifying the SDGs of greatest relevance, building capacity, and embedding the SDGs into its decision-making processes.

In 2021, DEWA won the prestigious EFQM UN Sustainable Development Goals (SDGs) Challenge, which recognizes DEWA's efforts in sustainable development and its support of the UAE's efforts to achieve the SDGs.

Through Space-D, DEWA is strengthening its efforts to support the SDGs by utilizing modern technology to deliver its electricity and water services. Space-D has both direct and indirect contributions to many of the Goals, including SDGs 6, 7, 9, and 11. ■

هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority

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Acting on science

As political mantras go, "we're guided by the science" ranks high. Yet established policymaking structures mean scientific considerations are often marginalized. We need bold reform now to place science genuinely at the heart of decision-making

By Kirsten Brosbøl, CEO and founder, 2030beyond, and Neena Joshi, Consultant, Lancet COVID-19 Commission

"I don't want you to listen to me. I want you to listen to the scientists. I want you to unite behind the science. And then I want you to take action." The words are Greta Thunberg's from her powerful address to the United States Congress in 2019, urging legislators to do what is needed to reach the Paris Agreement target to limit global warming to well below 2°C, preferably to 1.5°C.

Greta, like many other young people, has questioned and criticized the inaction by politicians and other decision-makers. And rightly so.

Because why is it that (putting aside a few notable exceptions in recent years) most politicians claim to follow science, and yet so many have the weight of scientific opinion against them? What can be done to create a more constructive relationship between science and government?

▲ Climate activist Greta Thunberg addressing the EU Parliament's environment committee, urging them to follow "a science-based pathway… nature doesn't bargain and you cannot make deals with physics."

The inconvenient truth

The key to understanding this paradox of inaction lies in the motives that drive politicians. Legislators are a heterogenous group, with various policy narratives and value systems. In liberal democracies, where they

are up for election once every four to five years, public opinion counts, and many competing interest groups will be fighting for their attention.

In my conversations with parliamentarians all over the world about how we can accelerate political action for the Sustainable Development Goals (SDGs), I hear many variations of the same argument: that jobs depend on the oil/gas/coal/agricultural/heavy industry, hence it would be political suicide to campaign for climate action. Or, particularly in the Global South, as long as people cannot feed their families and do not have access to electricity, talking about global issues such as climate change is a luxury no one can afford.

Scientific opinion is not always the same as public opinion, nor in the interest of powerful stakeholders and potential campaign funders. Fifteen years after Al Gore's film "An Inconvenient Truth," its title is, tragically, still spot on. Science presents politicians with an inconvenient truth, because it is not opportune for them to act upon it.

Outdated economic models

There are, however, true leaders among our elected representatives who understand the significance of science-based policy. These pioneers are willing to challenge public opinion and show leadership in their communities. But they face challenges inside the political system: not just by political opponents, but also by rigid and outdated economic models that dictate which policies are considered good investments and which are seen as red (negative) numbers on the bottom line. Spending on clean air, clean water, biodiversity, climate adaptation, and prevention of climate change often come out as red numbers, as the cost of inaction is not part of the metric.

These models have not been updated according to the science, and this contributes to the lack of multisectoral buy-in. The models are not multidimensional, do not encourage legislators to think outside of their specific sectors, and do not consider the cost of inaction, such as the cost of environmental degradation. This is why many good policy initiatives are blocked due to lack of initial funding.

Lost in translation

To move towards science-based policy, the scientific community must be able to operate according to these dynamics. It is not enough to present solid scientific evidence, data, and facts that are continuously "lost in translation" in the meeting with habitual thinking, competing narratives, and a political culture of "who strikes first."

It is encouraging to see examples of academic institutions around the world beginning to break down silos and work across the sciences, arts, and humanities and take on a more forward-leaning role. Alliances with other stakeholders, grassroots movements, and activists are needed to further align public opinion with scientific opinion. As an example, Columbia University in the City of New York has defined a fourth purpose, besides research, education and service. It is:

"The advancement of human welfare through the complex process of merging scholarly knowledge and our distinctive intellectual capacities with groups and institutions beyond the academy that respect what we do, possess the skills and power to bring about change, and are dedicated to doing that work in partnership with us."

It is necessary to use different channels and "messengers" to translate the science into actionable policy design that legislators can transform into action.

Strengthening the science–policy nexus

As academic institutions must redefine their role, so must parliaments. While governments often have well-defined channels to draw on the scientific community, legislators do not have access to the same established scientific networks. Institutionalizing the dialogue between the scientific community and legislators can ease the introduction of evidence-based information into the political realm, encourage productive discussion and debate among legislators, and promote multisectoral collaboration.

Regular dialogue will also help the scientific community understand the political processes of creating and implementing policy, empower them to present holistic rather than fragmented evidence, and view legislators as partners and colleagues rather than one-dimensional or untrustworthy individuals.

Ideally, parliaments should establish structures and mechanisms to institutionalize this nexus and provide the structure for the dialogue to take place on a regular and systematic basis. In the absence of this, other actors might support that dialogue to happen.

Think tanks and do tanks, interest organizations, and councils are working to strengthen the science–policy nexus by creating a space for the scientific community to engage with policymakers. This can increase the mutual understanding of what information is needed, and provide economic, social, and environmental perspectives of the scientific evidence, as well as address the bottlenecks that keep evidence from influencing policies.

By using the SDGs to guide their research and policy advice, these

"Think tanks and do tanks, interest organizations, and councils are working to strengthen the science–policy nexus by creating a space for the scientific community to engage with policymakers

© Hannah Peters / Getty Images

▲ New Zealand Prime Minister Jacinda Ardern's science-led response to the COVID-19 pandemic was conspicuously effective

groups have been able to ensure that policies that advance the progress on environmental and health goals do not hinder economic growth. They have also identified how policies promoting affordable and clean energy, and responsible consumption and production can accelerate economic progress.

Councils and platforms like the International Science Council and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) are providing policymakers with scientific assessments about natural and social sciences and are suggesting tools and methods to protect natural resources and global sustainability. They are focused on catalyzing international scientific expertise to effectively integrate science into policy and public action.

The Sustainable Development Solutions Network (SDSN) Europe is facilitating the policy–science nexus by presenting evidence and providing policy recommendations from economic, climate change, and equity perspectives. SDSN Europe's report, Transformations for the Joint Implementation of Agenda 2030 for Sustainable Development and the European Green Deal is guiding the European Union's COVID-19 economic recovery, the region's plan to achieve the SDGs and the implementation of the European Green Deal. It is doing this by providing actionable strategies for policymakers that align with their values and goals, such as ensuring their constituents' job security.

Parliamentarians for the Global Goals (PfGG) is connecting parliamentarians all over the world with global thought leaders and experts in collaboration with SDSN with an ambition to establish national fora for dialogue among legislators and academia. These fora will help develop concrete policies and campaigns for the SDGs and encourage cross-party dialogue and collaboration. They will also strengthen the exchange of ideas between academia and legislators to accelerate political action for the 2030 Agenda and increase the localization of the SDGs.

Wake-up call

It is remarkable that a Swedish teenage activist has had more luck, or skill, than most scientists to get the attention of decision-makers and the media to advocate for science-based policy. It is also a wake-up call and lesson about the missing links, the failure of our traditional structures, to bridge the gap and translate what we know into what we do. Recalling the words of Greta Thunberg, she and her generation are asking us to "act as you would in a crisis. I want you to act as if our house is on fire. Because it is."

In times of crisis, we need courageous leaders who are willing to take risks and put their own personal gain aside, to go against public opinion if needed, to do what is right. We need innovation and thought leadership to replace old models with new ones for a new reality. And we need to mobilize – together. ■

Fostering innovation

The Decade of Action demands rapid and impactful innovation in all areas to make Agenda 2030 a reality. How can we achieve this?

© UNDP Uganda / Steven Goldfinch

By Nebojsa Nakicenovic,
Director, The World in 2050

Innovation, as a collective learning process, has been the foundation of human and societal development since the dawn of civilization. Innovation was the central force of the "explosive" nature of the Industrial Revolution, which has resulted in enormous benefits for humans and fundamentally changed settlements, families, societies, the way of life, work, and interaction among people and their social networks. Significantly, life expectancy has doubled and half of humanity now benefits from secondary education.

However, this explosive development has also brought about negative environmental and societal impacts and left billions to live in poverty. This phenomenon was especially pronounced during the last half century of the "Great Acceleration" when it brought about a new era in human history, the age of the Anthropocene. This is a critical crossroads where further unconstrained development may expose societal and environmental tipping points and possible collapse. It is a period in which one species dominates planetary processes. Yet that species has an ever-increasing awareness of its own responsibility for stewardship of the Earth, nature, and its own future.

This "paradox of innovation" is that it is both at the core of human progress and a major cause of human interference with the environment and planetary processes. At the same time, innovations in the broader sense will provide many possible solutions for achieving a sustainable future for people and planet. Innovations need to be fostered, nurtured, and supported as their emergence is not automatic.

◂ Isingiro, Uganda, using drones to create a refugee settlement base map that will enable evidence-based development decisions. Digital technologies can act in a leapfrogging capacity, levelling up countries with less well developed infrastructure

They depend on human capacity and ingenuity empowered by the right conditions and "social steering."

Winners and losers

Innovation in its simplest terms is an emergence of novelty, originating from human endeavor and inspiration. Innovations range from radical new inventions to incremental performance improvements. They encompass technological, social, and behavioral changes reflected in processes, products, and institutional change.

Innovations that are successful typically undergo widespread diffusion, upscaling, and commercial uptake. However, this outcome is the culmination of an often lengthy process, which runs from research and development (R&D) through demonstration and trials to early market formation and then diffusion. It is not a linear but an interactive process. Learning by doing and using are central to improvement, scale up, and ultimately successful diffusion.

There are countless pitfalls along the way. The process is characterized by deep uncertainties: one can say that "many are called but few are chosen." The majority of innovations end in failure: some abject, others marginal. Innovation is neither costless nor determinate. Even successful innovators often have a history of failures that are important learning experiences for the eventual adoption.

Supporting innovation

This renders support of the innovation process difficult because the discovery processes are unpredictable, making it impossible to "pick" winners. The support and social steering of the process needs to foster the right conditions for innovation and for new ideas. Unfortunately, there are no silver bullets. That support needs to be adequate and sustainable from both public and private stakeholders, through both policies and the public at large.

The appropriate policy support can guide innovation and development, including the emergence of values, policies, and systems, to support sustainable development toward a safe and just future for all. This is more critical than ever, as the current rate and direction of innovation is insufficient to achieve the 2030 Agenda with its 17 aspirational and ambitious Sustainable Development Goals (SDGs).

In part this inadequacy is due to a relatively narrow focus on technological innovation without fully addressing societal, institutional, and cultural innovation. And it's also in part due to underinvestment in innovation. As innovations constitute new knowledge, they are difficult to fully appropriate by the private sector.

Consequently, the private sector, with its focus on short-term profitability, inherently underinvests in innovations that have a general purpose or facilitate public goods that support sustainable development. This particularly applies to fundamental R&D, and public goods such a health care, education and infrastructure. This then must be offset by the public sector, by foundations, and by new investments in a sustainable future for all.

Balanced innovation

The quest for innovation needs to be guided by balance: benefits must be fairly shared within society and societal gains must respect planetary boundaries. Innovations must be socially directed toward assuring the basic needs of all, addressing inequities and inclusion.

Yet this is not sufficient, as much more needs to be done to foster decent and good life for all. This would also involve efforts to improve efficiencies at all scales and reduce the pressures on the Earth's systems. Simultaneously, innovations must drastically reduce the need for new materials through circularity (resource reuse and elimination of waste).

Three elements of innovative processes need to be strengthened: efficiency, sufficiency, and circularity. Efficiency and sufficiency transformations to sustainable

and resilient futures minimize the environmental harm by lowering the energy use or material requirements of a product or service. Innovations (from micro and macro perspectives) need to anticipate and integrate both short and long-term effects. This is to avoid the risk of overall unintended impacts that may cause an increase in harmful environmental and social impacts, ideally through evidence-based feedbacks to the societal discourse.

The diffusion of innovations, including dematerialized societal innovations, can contribute to a more sustainable future for all, as envisioned by the UN 2030 Agenda and the Paris Agreement.

// For rapid transformation to occur, investments should be directed toward innovations with high learning and diffusion potentials

Emissions of greenhouse gases (GHGs) are an example of one of the largest waste flows related to human activities but would require a fundamental transformation from primary reliance on fossil energy toward zero-carbon alternatives and uses. In some sense, the challenge is not only to innovate but also to change the way we live, work, and behave. It will be next to impossible to achieve these complex and multiple goals through incremental innovative processes. Rather, we need synergies across fundamental transformations.

Digitalization is an early sign of such a fundamental change that has been accelerated through the tragic COVID-19 pandemic. Most important, however, would be to develop more proactive efforts to promote diffusion and learning, foster education, and address barriers, constraints, and unintended consequences of innovations.

Ingredients for success

One of the best examples of digitalization and the epitome of successful innovation is the worldwide spread of mobile phones. The first mobile phone was introduced three decades ago. Today, essentially everyone in the world has one, including about a billion people without access to electricity. There are approximately 10 billion phones for almost eight billion people. Significantly, the diffusion occurred essentially synchronously throughout the world, among rich and poor. In many important ways it is a leapfrogging technology. This is especially the case with smartphones that provide internet access, banking, billing, and many other important services. At the same time a smartphone uses about a hundred times less energy than the myriad analogue devices it replaced: from the television and fax machine to the alarm clock and satnav. It also requires 25 times less material and energy to produce. All told, this results in a hundredfold decrease of GHGs without even changing energy supply.

There are other examples of such breathtaking innovation diffusion: from photovoltaics and windmills to laptops, tablets, and the internet. What they have in common is "granularity" rather than large "unit size." More granular innovations can be expected to have:

- faster diffusion
- lower investment risk
- faster learning
- more opportunities to escape lock-in
- more equitable access
- high job creation
- larger social returns on innovation investment

In combination, these advantages enable rapid change. This is highly relevant for the role of innovations in the context of transformative change. It indicates that for rapid transformation to occur, investments should be directed toward innovations with high learning and diffusion potentials. So, while innovation processes are characterized by deep uncertainties, the strategy of supporting innovations that are inherently granular increases the likelihood of rapid diffusion and benefits for people and nature.

Where to focus?

Digital technologies are examples of innovations with rapid diffusion because they are granular, even though they are embedded in large and complex infrastructures and systems. Examples of granular innovations include:

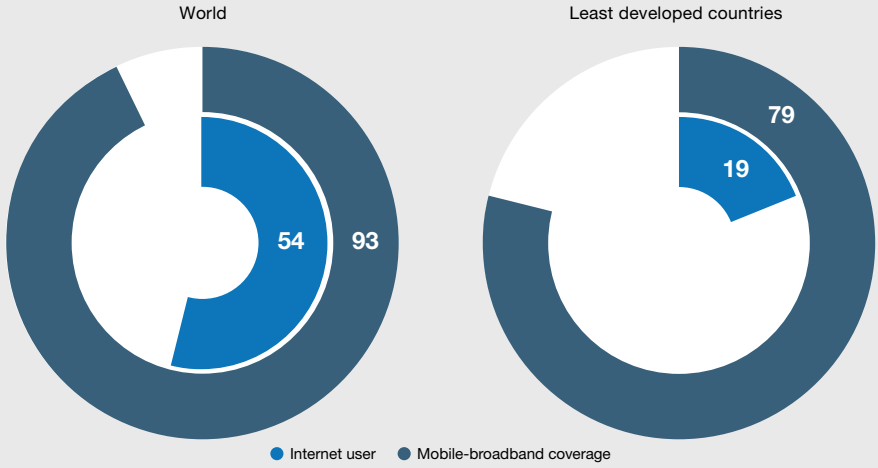
- artificial intelligence
- connectivity (the Internet of Things)
- digitalization of information
- additive manufacturing (such as 3D printing)
- virtual or augmented reality
- machine learning
- blockchain
- robotics
- quantum computing
- synthetic biology

As mentioned previously, balance needs to be an overarching principle. Digital technologies have spread rapidly in much of the world. They can help to overcome social inequalities, but they are also characterized by inequalities themselves. Large disparities exist in access to, usage of, and skills relevant for digital innovations, summarized as the "digital divide." Even more importantly, gaps also exist in the broader development benefits from using digital innovations. Digitalization has often boosted growth, expanded opportunities, and improved service delivery. Yet the aggregate impact has fallen short of being inclusive and is thus unevenly distributed. Because of its generally granular nature and fast diffusion and learning rates, digitalization is reshaping work, leisure, behavior, education, health, and governance, and can facilitate the achievement of the SDGs.

Digital technologies and innovations are disrupting production processes in nearly every sector of the economy, and this has been accelerated during the COVID-19 lockdowns. In general, digitalization can raise labor, energy, resource, and carbon productivity, lower production costs, expand access to services, and dematerialize production. But without proper policy frameworks and social "escape hatches," it can also leave many behind.

On a global level, what is commonly described as the digital divide boils down to a physical reality, access to the internet. There are also clear dangers and downsides to digitalization, including job losses, rising inequality, and the further disparities of income, from labor to capital. Digital identities can be stolen, or artificial identities can be created. Proprietary digital information can be stolen. Governments and private businesses can invade privacy and monitor individuals against their will or without their knowledge.

FIGURE 1: The digital divide
Mobile connections are practically universal, but about half the global population are offline, mostly in LDCs



Proportion of population covered by a mobile-broadband signal and using the internet, 2019 estimates (percentage)

Source: Sustainable Development Report 2021

The challenge to change

Research systems and organizations that are based on traditional social and industrial structures, lifestyles, culture, and science and technology must be redesigned for the age of the SDGs, digitalization, and beyond, toward other innovations: from agenda-setting processes, funding, and evaluation systems, to human resource development methods and career paths. It is necessary to diversify R&D investment and priorities according to actual needs and context. Collaboration between natural sciences, humanities and social sciences is essential. Cooperation between supply and demand sides and the combination of top-down and bottom-up approaches is important.

We need to accumulate, share, and feedback those efforts for reflection and transformation. It is necessary in parallel to recognize the importance of preserving basic science, and a dialogue between policymakers and researchers. Building trust and maintaining scientific quality, integrity, and codes of conduct are also important. Finally, evidence-based science for policy is essential for fostering innovation for the SDGs.

However, initiating transformation is difficult. This is due to institutional inertia by incumbent actors with vested interests, and consumers or users stuck in comfortable routines. In addition, the globalization of economic and social activities that has occurred over past decades has created intricate webs of activities, making transformation a complex process. Furthermore, existing studies indicate that current policy instruments are either absent or ineffective for achieving the magnitude of transformation needed in the expected timeframe. This means that unless there are substantially advantageous (simple, low cost, superior, and universal) alternatives offered to individuals, achieving change will continue to be difficult.

Conclusion

COVID-19 is a great human tragedy, but may provide an impetus to accelerating innovation and transformative change. The pandemic and the ensuing economic upheaval have shown the dangers of degrading ecosystems and nature, as well as the need for international cooperation and greater social and economic resilience. The crisis has had major economic costs and is triggering significant investment pledges. Ensuring that these investments support transformative and innovative change is key to achieving the SDGs.

The full unfolding of the "digital revolution" will have even deeper impacts on our societies, creating the next generation of sustainability challenges. Moreover, the digital transformation may redefine our own concept of ourselves as humans. In the Anthropocene, humans become the main drivers of Earth-system changes. In the "digital Anthropocene," humans will also start to transform themselves, enhancing cognitive capacities into what can be called "Homo digitalis." This could be the next disruptive innovation to transform humanity for the benefit of all people, and the planet. ■

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Speeding up progress

We need to radically speed and shake things up to meet the 2030 deadline. “Incubators for transformative partnerships” could be a critical tool to fast-track action on the SDGs

By Carlos Mataix Aldeanueva, Director, Innovation and Technology for Development Centre, Universidad Politécnica de Madrid (itdUPM); Teresa Sánchez Chaparro, Scientific Director, itdUPM; Julio Lumbreras Martín, Vice-Rector for Academic Strategy and Internationalization, UPM; Jaime Moreno Serna, Technical Director, itdUPM; Miguel Soberón, SDG Integrator, itdUPM

Multi-stakeholder partnerships can be effective in promoting the collaborations necessary to implement the transformations to achieve the Sustainable Development Goals (SDGs). However, by themselves they may not be enough to produce the structural changes we need in time. We need ambition combined with spaces to connect and learn, to ensure that collective efforts do not break down into silos, and that partnerships are effective for enabling change. Below we explore five characteristics that can accelerate the “next generation” of collaborative practices.

Based on our experience, the following five ingredients increase the transformative potential of multi-stakeholder partnerships:

1. They link to public policies

While the purpose to which the partnership aims to contribute is defined among the partners, it should aim to develop a public policy connected with the SDGs. Ideally, the partnership includes a responsible public administration.

2. They address intractable problems

Transformative multi-stakeholder partnerships address “wicked problems” that do not have a defined solution, are affected by high levels of uncertainty, and cannot be addressed by a single organization or specific policy. The course of action is usually to improve the situation rather than to solve it.

3. They articulate the aspirations of a diverse set of partners for transformative change

The collaborative value created in the initial stages of a partnership is generally based on philanthropic or transactional

◂ Backstage during the Circular Sustainable Fashion Week, Madrid, Spain. The show promotes designers and brands with a commitment to sustainability, eco-design, and the circular economy. A combination of bottom-up and top-down approaches is a prerequisite for the success of transformative partnerships

approaches. Austin and Seitanidi (2012) identified several critical factors (such as the level of commitment of the partners, the scope of their activities, trust, and the generation of synergistic value) for a partnership to evolve, or even start in a transformative state. A wide diversity of participants is also essential to maximize the amount of resources, ideas, and experiences that interact in a partnership.

4. They affect singular points of a system

Participants working in specific niche areas within a system have opportunities, through partnerships, to scale innovations from prototypes to mass production, exerting influence over the conditions in which the system operates.

5. They include an enabling facilitator

Creating a successful collaboration of disparate partners can be challenging. Successful partnerships often include a facilitator (normally performed by an individual or organization). The facilitator can help to evaluate incentives, create consensus, establish a distributed governance, and so on. In short, a facilitator generates a comfortable space for all the partners.

Connecting partnerships

Some authors point out that partnerships with a transformative vocation should not just be created "spontaneously" through "bottom-up" processes, since these can be hampered by lack of ambition, short-termism, insufficient coordination mechanisms, or misaligned incentives. In addition, initiating a partnership takes energy and resources, and sustaining the commitment of multiple actors in the medium term is complex (see, for example, "Transnational multistakeholder partnerships for sustainable development: conditions for success").

So, in our experience, there is a need for intermediary spaces that connect partnerships aligned around common transformative processes that combine both bottom-up and top-down approaches. The initiative El Día Después (The Day After) is an example of such a space. It is promoted by the Sustainable Development Solutions Network Spain (REDS), the Innovation and Technology for Development Centre at Universidad Politécnica de Madrid, the Barcelona Institute for Global Health, and the energy company Iberdrola.

The Day After launched in March 2020 to provide an SDG-based response to the crisis triggered by COVID-19 in Spain. It creates spaces for connecting, learning, generating shared meaning, and incubating innovative projects. It does this through the stable and deep collaboration of a large number of public institutions, private companies, civil-society organizations, and academic entities. Connecting the partner networks of multiple organizations and designing from the priorities of these networks leads to greater efficiency. It means participants can take advantage of joint learning, and that partnerships can focus on activities with the highest potential for systemic change.

Incubators for transformative partnerships

The Day After initiative therefore inspired the notion of an incubator for transformative partnerships, similar to an entrepreneurship incubator. This would be a multi-actor organizational vehicle aimed at connecting and accelerating partnerships, facilitating the incorporation of systemic approaches and practices, and cross-learning between initiatives. Below we consider how such incubators might compare with transformative partnerships through their life cycle.

In the early stages of defining their scope, transformative partnerships dedicate collaborative energy to solving complex problems. Their focus is on concrete results. Incubators, however, orient their action towards systemic change. Both collaborative vehicles rely on a "challenge owner approach," a demand-led innovation strategy that places public policy at the center of the innovation process. Partnerships develop through a facilitation function (a person or institution) to promote homogeneity and conditions of symmetry among the partners. For incubators, this function is equally developed but is performed by all the incubator drivers.

When transformative partnerships begin their public activity, there is usually a tension between flexibility and formalization, often leading to explicit regulations to facilitate implementation. In incubators, however, there is more of a trend towards flexibility, with an emphasis on trust and shared vision. In both cases, operations are conceived as a continuous design process.

Partnerships tend to place more emphasis on planning and monitoring, whereas incubators focus more on aligning a vision. When it comes to generating value, partnerships orient towards execution, utilizing the specific capacities of the partners, while incubators lean more towards a "portfolio approach," integrating learning and emerging opportunities.

Consequently, partnerships and incubators are complementary instruments. Notably, partnerships aimed at solving specific problems can amplify their transformative potential by connecting public policy and its most relevant actors within an incubator. In addition, by sharing experiences with other partnerships through an incubator, efficiency and impact increase.

This reduces the learning curve, strengthens trust between partners, accelerates escalation processes, and creates a common roadmap to tackle more complex problems. Thus, the notion of a "convening incubator for transformative partnerships" can be an instrument with huge potential for implementing Agenda 2030 through stable and complex interaction between public, private, social, and scientific actors. ■

Education to achieve the SDGs

Making the SDGs a reality will require people with new mindsets as well as new skills. Education is critical, and must rise to the challenge of enabling learners to drive sustainable development forward at the scale and pace required

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By Chandrika Bahadur, Director, SDG Academy, and Vice President of Education, Sustainable Development Solutions Network (SDSN); and María Cortés Puch, Vice President for Networks, SDSN

The world has less than a decade left to achieve the Sustainable Development Goals (SDGs). The COVID-19 pandemic has made meeting this deadline even harder. Even before the pandemic, no country was on track to achieve all the SDGs (as seen in the Sustainable Development Report 2020).

The pandemic has brought about greater awareness of our vulnerability and of the urgency of advancing sustainable development with multidisciplinary solutions. It has highlighted the role of science and the complexity of the challenges we face, interconnected across disciplines, sectors, and countries. It has also shown the breakthroughs that science can achieve within months if scientists are able to share their knowledge, and if the public and private sectors work together. We now have an opportunity to change how we confront the challenge of sustainable development and enact the deep transformations that are required.

To succeed in the biggest challenge of our time, education will be vital. Achieving the SDGs requires a shared understanding of sustainable development, including the complex interactions between systems, as well as advanced mechanisms to bridge across sectors and disciplines.

Education processes can expand a comprehensive and multidisciplinary body of knowledge, as well as contribute to changing how we analyze and confront problems. Achieving the SDGs will not just require people with the right skill sets, but also new mindsets, more cooperative processes, and real-life applications. Through education, learners can make links between theory and concrete challenges, opening up new opportunities to improve the lives of people within our communities. In being trained to find and pursue realistic opportunities to achieve change, learners can be empowered as active actors in shaping their future, creating new narratives of hope for the future.

◂ Schoolchildren in Watamu, Kenya, learning about conservation, release a sea turtle back in the ocean

Challenges

The SDGs require deep and radical transformations in each country and in the way we approach every one of our activities. Current education systems and pedagogies at all levels are ill-equipped for preparing learners to take on ownership and leadership at the scale and pace required by the SDGs. We describe three challenges below.

First, the interdisciplinary nature of the SDGs is at odds with the focus on specialization that is a defining feature of higher education. The Accelerating Education for the SDGs in Universities guide proposes a number of examples of how to successfully support cross-university, interdisciplinary collaboration on education for the SDGs that can address the need to train specialists who are also able to work across epistemological fields. Such efforts need to begin at the institution level. Avenues for cross-disciplinary projects or areas of research and practice need to be developed within universities.

Second, high schools and universities lack trained teachers or sufficient resources to cover all SDG-relevant fields of knowledge. Educators will need to identify opportunities to work with resources outside of their institutions, including:

- financial resources
- involvement of working professionals as adjunct professors or invited speakers
- recognition of collaborative projects as part of their formal curriculum

Third, the fields of study covered by the SDGs are evolving in real time. We are constantly grappling with new evidence, new challenges and new solutions. Academia needs to keep up with these developments and build them into its existing body of knowledge.

This is a challenge for those fields of study where deliberative, careful research is the norm, and where evidence needs to pass through several layers of scrutiny before taking its place as established wisdom. It is exacerbated by the democratization of information and the shift in the role of the instructor from being the font of knowledge to being the curator of knowledge. Educators need to be much more agile and adept at processing new information, while at the same time keeping to the high standards that define their field.

Educating for the SDGs today

Through the SDG Academy and the recently published report on accelerating education for the SDGs in universities (mentioned above), SDSN has been proposing ways to address the key principles of an evolving education in the service of the SDGs. These principles include:

- interdisciplinarity (working across traditional silos and disciplines of knowledge)
- systemic approaches (studying societies and economies as single systems to better understand sub parts)
- action-based learning (grounded in real-life problem-solving)
- multi-actor involvement (recognizing the role of different stakeholders)
- solutions-oriented approaches (applying knowledge to practice)

As part of this work, SDSN has identified over 300 cases from universities from around the world that can help inspire other teaching institutions and promote scaling.

Universities are taking diverse approaches that are well suited to their contexts. Some are organizing

activities to raise awareness in their communities, such as social media campaigns, public events, or co-curricular activities that focus on sustainable development.

For example, "entrepreneurship challenges" or "living labs" are processes that can bridge across sectors. They can gain the wide interest of local communities while providing students with opportunities to develop the skills and mindsets of sustainable development. These activities allow a degree of design innovation that can be difficult to implement in a formal curriculum.

Other institutions are incorporating the SDGs into their existing curriculum via SDG-focused capstone projects, case study analysis, exercises, lectures, or readings. The SDG Academy has reached over 850,000 learners across 193 countries with its content of over 35 courses, covering topics of the SDGs. The courses are taught online by faculty from different parts of the world, and focus on solutions that work.

An important focus is to teach learners the range of actions needed at different scales of implementation (local, national, global), and to help understand what works in different contexts. More importantly, a global cohort of learners fosters a multi-cultural dialogue, exposing students to ways of examining the same challenge from different lenses.

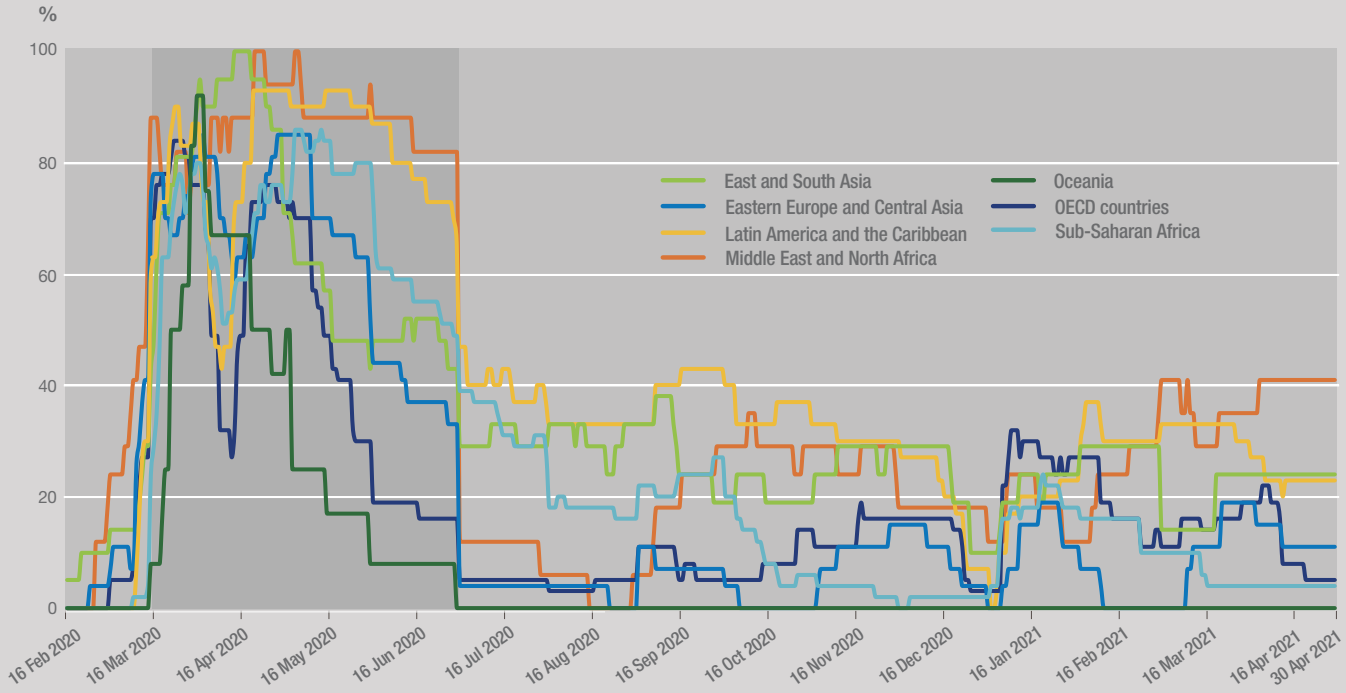
SDSN is also working, through its Global Schools Program and Mission 4.7, with ministries of education to review existing curricula from the perspective of the SDGs. The aim is to understand how best to update and integrate sustainable development topics into existing pedagogies.

This shortlist of examples shows that institutions of many sorts are advancing education for the SDGs. However, the scale of the necessary transformations to achieve the SDGs will require mainstreaming sustainable development education and drastically scaling up successful initiatives.

The COVID-19 pandemic has, in just 15 months, mirrored the challenges and opportunities we face in sustainable development: the enormity of a global challenge, experienced differently in different parts of the world; the need for collective solutions, driven by science, but localized for impact; the need to keep pace with an evolving challenge and multiple sources of information around it; and the dangers of fragmentation, both of knowledge and effort, in limiting our ability to collectively address the most critical challenges of our times.

We have a unique opportunity to build a generation that can create a more just, equal, prosperous, and sustainable world. Let us, educators worldwide, not squander that opportunity. Let us work to create education systems that are fit for purpose to achieve the SDGs. ■

FIGURE 1:
Percentage of countries in each region in which schools were closed due to COVID-19



Source: Sustainable Development Report 2021. Based on UNESCO (2021)

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A new era of multilateralism?

The last four years have seen a fractured and antagonistic approach to global affairs. What are the prizes to be gained from global leaders working together towards common goals? Is a new era possible?

By Miguel Ángel Moratinos, High Representative for the United Nations Alliance of Civilizations (UNAOC)

Long gone are the days of the so-called "Westphalian order" in which countries sought the "balance of power" (preventing any one state from gaining enough military power to dominate all others) as the framework to regulate the international system. We had to wait until the horrors of the first world war for a Copernican change in world governance. The idea was to abandon the old system of alliances and ententes that arose from that desired balance of power. In its place would be a system of collective security in which all actors would take responsibility in the search for a new, more just, and peaceful order.

It did not work immediately and the League of Nations could not prevent the atrocity of a second world war accompanied by the barbarity of a holocaust that brought humanity face to face with its own destruction. Never had the human being descended to the hells of his maximum evil.

▲ Women peacekeepers from the United Nations Interim Force in Lebanon (UNIFIL) on community outreach in a market in Tyre

It is true that a perfect multilateralism never existed. For it to work, a "directorate," the Security Council, had to be inserted to lead the work and developments of this new world

governance. A good synthesis was achieved: universal participation of all the Member States of the international community was achieved through the UN General Assembly, while the Security Council, with five permanent members, mobilized and controlled the development of events.

This was more than 75 years ago. Today, the United Nations, the ultimate symbol of multilateralism, needs and seeks reform of the entire multilateral system. The need to adapt the model that emerged in 1945 to the new realities and challenges of the 21st century is obvious. There is unanimous agreement on the urgency of reform to make the multilateral system more effective and credible. The COVID-19 crisis has only corroborated, highlighted, and amplified the inadequacies and contradictions of multilateralism today.

It is true that in the face of this global health challenge, no one could deny a call for the need to strengthen and reinforce multilateral bodies as much as possible. This is what Secretary-General António Guterres tried to lead. During this pandemic, his appeals, initiatives, and proposals have always been aimed at providing the entire multilateral system with resources and support.

The response has been ambivalent. On the one hand, we have generally witnessed declarative support for multilateralism. Except for the unilateralism of the previous American administration, most of the main actors proclaimed their support for and adherence to the value of multilateralism. On the other hand, this support was often limited to diplomatic declarations that were later called into question by nationalist and unilateralist behaviors and conducts, where "everyone for themselves" seemed to win the day.

Contradictory measures, a lack of international coordination, vaccination campaigns where the common good of humanity was not contemplated: all this combined with deep discriminatory social ruptures where sectors of the population felt marginalized because of gender, race, ethnicity, or religion.

New crossroads

In these circumstances there seems to be no escape. Humanity in general and nation states in particular are facing new crossroads very similar to the ones that occurred after the two world wars. The world is increasingly interconnected, more global than ever, and totally interdependent. We can only wonder how we will have to act to order and regulate collective coexistence in the coming decades of this century.

This is where multilateralism emerges as the unavoidable response to this new reality. All analysts agree that the global challenges of the 21st century cannot be resolved unilaterally. What is needed is a world governance in which effective, democratic, and sustainable multilateralism can provide a response to all of them. This new multilateralism must take note of and draw inspiration from the lessons of the past and from some recent initiatives that have yielded good results.

I refer particularly to the Sustainable Development Solutions Network (SDSN) and its Leadership Council. Under the leadership of Jeffrey Sachs and with the support of then-Secretary-General Ban Ki-moon, this advocacy initiative was launched to firstly achieve the adoption of a forward-looking agenda, and then to support the advancement of the 17 Sustainable Development Goals.

The idea of creating a Leadership Council composed of about a hundred people from different spheres of expertise marks a revolutionary innovation in the way problems are addressed within the United Nations. Academics, scientists, politicians, businesspeople, representatives of civil society, and others formed this council to raise awareness in our societies, adopt the 2030 Agenda for Sustainable Development, and then provide practical solutions to the problems that would appear when trying to advance the Agenda.

There is now unanimous awareness of this agenda. Most countries have begun to incorporate it into all their national policies.

Lessons learned

Effective, democratic, and sustainable multilateralism can only be achieved if we are able to avoid falling into the old traps of the past.

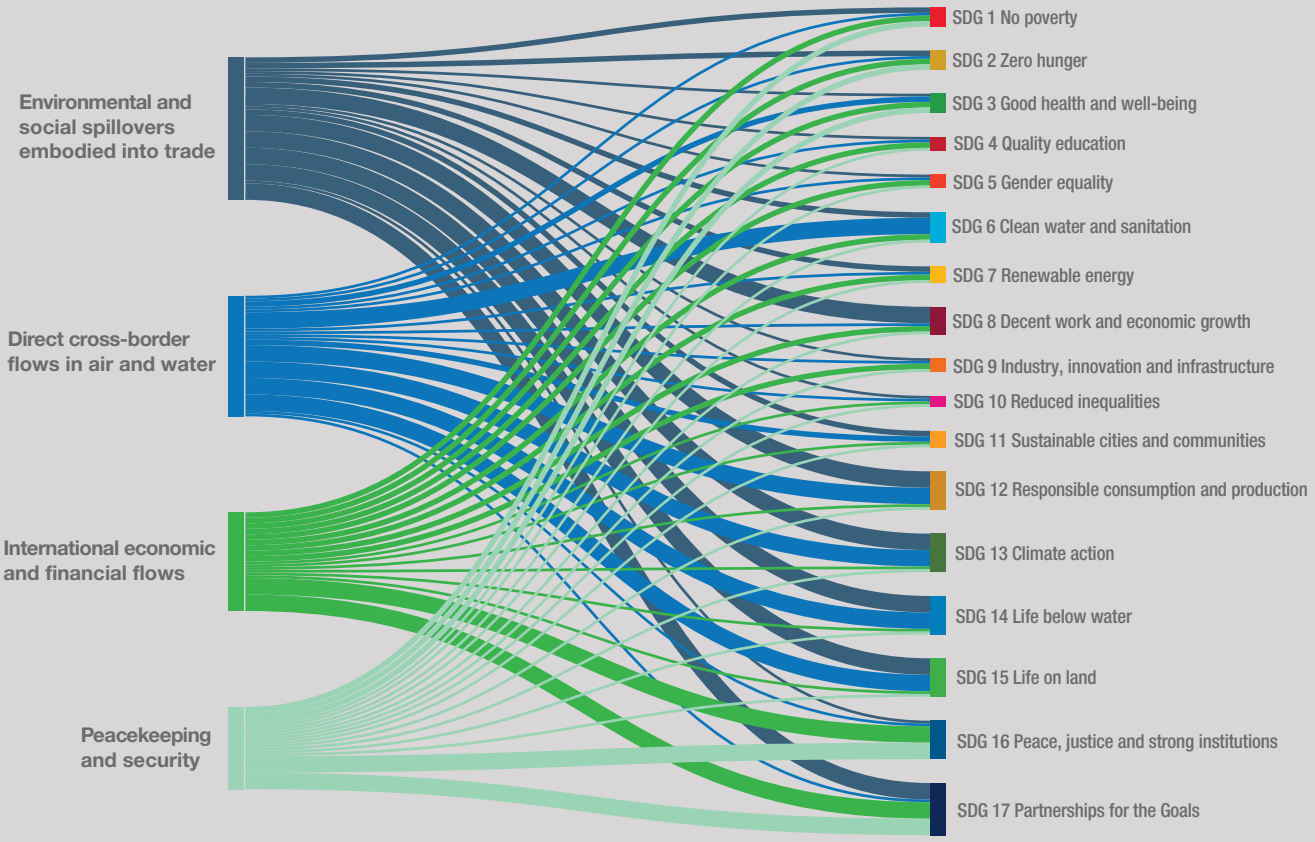
The first is to avoid at all costs the resurgence of new "cold wars" or "bipolarities." The last few years, and in particular the latest diplomatic episodes, show us a new hegemonic struggle that all of us who advocate genuine multilateralism would like to avoid. We cannot set the new multilateral framework of the 21st century if we find ourselves with a belligerent attitude among the main actors of the international community.

The relationship and competition between the two leading powers, China and the US, must be constructive and with a shared purpose: to promote the reform and adaptation of multilateral structures for the benefit of all humanity. Without the "G2," we cannot imagine a new sustainable multilateralism.

However, neither can we be satisfied with what might be called a multilateralism à la carte where the two major players agree only on a few essential issues but disagree on the other elements of this new governance. It is not enough to be multilateralist only in favor of the fight against climate change and the eradication

"Any new reform of the world's organization must build on the participation of the multiple actors that shape the day-to-day of our political action

FIGURE 1: International spillovers and the Sustainable Development Goals



Note: Detailed Excel file available at www.sdgindex.org
The width of the lines denotes the degree of impact: (3) Direct significant impact, (2) Moderate impact (direct or indirect) and (1) No or limited impact.

Source: Sustainable Development Report 2021

of pandemics while at the same time being nationalist and unilateralist in trying to resolve the other challenges facing the international community.

It is not a matter of standardizing the thinking and political action of each of the Member States and of the main actors that can drive the new world. Instead, it is about reaching a level of understanding on the major principles and values that multilateralism in the 21st century needs. The second mistake is to ignore the radical changes that have taken place over the last few decades and to approach the reform superficially as "business as usual."

Technological, scientific, economic, cultural, and social advances have totally modified the reality and behavior of all our societies in recent decades. Therefore, any new reform of the world's organization must build on the participation of the multiple actors that shape the day-to-day of our political action. We cannot continue as if nothing has changed.

The nation states are the main subject of the international concert, but alongside them are a whole series of new actors who legitimately demand their participation on this new multilateral stage. We cannot seek solutions today and guarantee their successful implementation if we do not incorporate private sector, scientists, academics, civil society, media, artists, athletes, etc. as the essential subjects of the new reality in this new multilateralism in a more democratic way.

There is therefore no alternative. The global citizenry, that single humanity, is the one that must mobilize. Through this, their respective states and governments can better understand the present challenges, and sapiens can continue to advance and develop all their human capacities without fear of falling into political or technological totalitarianism.

The answer lies with the almost eight billion citizens of the world who, at the end of the day, are the ones who suffer from wars, conflicts, hunger, misery, pandemics, and acts of terrorism. These are the same eight billion citizens who wish to save the planet and humanity. We can only achieve this through effective, democratic, and sustainable multilateralism. ■

America back on board

The US is once again committed to tackling climate change. Can it succeed, and take the rest of the world with it?

By Elena Crete, Program Manager, Sustainable Development Solutions Network (SDSN); Helen Bond, Associate Professor, Howard University; Dan Esty, Hillhouse Professor of Environmental Law and Policy, Yale University; and Gordon C. McCord, Associate Teaching Professor, School of Global Policy and Strategy, University of California San Diego

◂ Smoke from wildfires hangs over the skyline in San Francisco, US. The country has been suffering an increasing number of extreme weather events that can be attributed to climate warming. The Biden-Harris administration has committed to addressing the threat on a national and global level

Only one year ago, the United States was mired in a pandemic with many Americans suffering as segments of the economy collapsed. The nation was on the verge of formally withdrawing from the Paris Agreement, and sustainability was nowhere to be found on the national agenda. A year later, a new president has taken office, the US has rejoined the Paris Agreement, and the Biden-Harris administration has recommitted to sustainability through a wide range of ambitious proposals and funding commitments at a level not seen since the 1930s.

While the US remains the second-largest greenhouse gas emitter in the world, nations across the globe have celebrated the re-engagement of the new president with the global effort to combat climate change. And leaders everywhere are eager to see how far the new administration will go to deliver on America's commitments.

When the UN General Assembly adopted the 2030 Agenda for Sustainable Development in 2015, it was with the expectation that all countries would work together to take urgent action on climate change, along with the other 16 goals put forward. We now have less than 10 years to achieve Agenda 2030, and meanwhile are moving ever closer to the dangerous climate tipping points highlighted by the Intergovernmental Panel on Climate Change (IPCC). Having the US on board is therefore essential if the world is to increase its climate action ambition, make the investments necessary to transition to a clean energy future, and design the policies needed to achieve a robust, just, and green economy.

No time to lose

On his first day in office, President Biden followed through on several of his most significant campaign promises and confirmed that climate change would be a top priority of the new administration. Most notably, just hours after being sworn in, the new president formally rejoined the Paris Agreement and promised to update the US nationally determined contribution (NDC) to climate change action.

As a first step in moving forward his Build Back Better campaign, President Biden also announced that he would host a global climate change summit at the White House to bolster ambition around the world in the lead up to the November 2021 Conference of the Parties (COP26) climate change negotiations in Glasgow.

This commitment to climate change mitigation was reinforced by the president's recently announced USD 2 trillion American Jobs Plan, which proposes to allocate billions of dollars in green infrastructure and clean energy investments as part of the US recovery post-COVID-19. In a series of executive orders, strategies, and policy announcements, President Biden has clearly signaled his intention to be a transformative leader with a deep commitment to the sustainability agenda, including:

- encouraging an-all-of government commitment to climate change action with climate change leaders appointed to critical government roles, including: Brian Deese as the Head of the National Economic Council; John Kerry as Special Envoy for Climate; Gina McCarthy as White House National Climate Advisor
- advancing climate leadership in new arenas by appointing: Transportation Secretary Pete Buttigieg; Senior Director for Buildings Emissions in the White House Council on Environmental Quality Mark Chambers; Treasury Secretary Janet Yellen; Trade Representative Katherine Tai
- revising how the social cost of carbon is calculated, correcting the Trump administration's methodology that had vitiated this tool for bringing climate change concerns into regulatory decision-making and governmental policy determinations more broadly
- working to reverse President Trump's regulatory rollbacks with a broad commitment to sustainability and equity, including not just action to strengthen America's pollution control rules and promote environmental justice, but also an economic framework embedded in the Made in America Tax Plan that would ensure that corporations pay their share of the costs of public services and encourage US job growth
- supporting community development and environmental justice efforts by revising how federal grant programs are awarded, and targeting benefits to frontline communities
- designing a robust infrastructure package commitment to building an electric vehicle charging network, investing in more public transportation, and revitalizing the industrial heartland of America

Making good on promises

The climate change debate in America is now shifting from whether to move to a clean energy future to how and how fast. Several teams of researchers have developed detailed deep decarbonization strategies for the US, highlighting the pathways to clean electricity by 2035 and full carbon neutrality by mid-century.

Two of these strategies include the National Academies of Sciences (NAS) Accelerating Decarbonization in the United States: Technology, Policy, and Societal Dimensions and SDSN USA's Zero Carbon Action Plan. Both of these studies take an in-depth look at the highest-emitting sectors, including buildings, industry, transport, and power generation, and aligning those sectors with an economy-wide decarbonization strategy.

If the US really is to be seen as back on board, the Biden-Harris administration will need to close the gap between, on the one hand, goal-setting, benchmarking, scenario-building, and policymaking, and on the other delivering transformative change.

The Biden team will also need to bridge the divides across federal agencies and from federal to state and local governments to capture all the opportunities available for the American economy. Achieving these national objectives will not be easy but the consequences of inaction are potentially profound.

What does all this mean for the rest of the world? President Biden's Build Back Better strategy fundamentally reasserts America's commitment to a sustainable future. His leadership sends a message to the entire world that the future is green. The potentially huge US investment in clean energy technologies will:

- spur new public-private partnerships
- advance research and development of a wide range of new technologies lower the costs of renewable power and other elements of our future sustainable energy economy
- create a new global market for low-carbon industries

Simply put, the United States is back and ready to promote innovation, entrepreneurship, and economic strategies that promise to advance sustainability at home and abroad.

> ***// President Biden's Build Back Better strategy fundamentally reasserts America's commitment to a sustainable future***

Much remains to be done on racial equality, public health, and overcoming America's deep political divides. Addressing these challenges alongside the effort to recommit the nation to the sustainability imperative will not be easy. Indeed, it will require a carefully structured and coordinated effort in line with the National Sustainable Development Strategy, which is part of UN Agenda 21 and calls upon countries to integrate economic, social, and environmental goals into a unified blueprint for action at the national level.

President Biden has signaled his intention to address these critical elements comprehensively and ensure a just transition to a sustainable future for America and the world in his opening months in office. But now the hard work of execution on this transformative agenda takes center stage. ■

At the turning point?

After years of rhetoric and little action, is this year finally the moment when political will, technological advancement, and ESG investment combine to set the Earth on a path to net zero?

By Jeffrey D. Sachs, Director, Center for Sustainable Development, Columbia University; President, UN Sustainable Development Solutions Network

After two centuries of relying on fossil fuels, the world will shift in the 21st century to zero-carbon energy sources. The direction of change is not in doubt; the pace of change is the huge question. Will the world change fast enough to avoid devastating costs of climate change? It's going to be a very close call.

Here's why. The Earth has already warmed by around 1.2°C compared with the pre-industrial average. That rise means that Earth is now warmer than during the entire 100 centuries (10,000 years) of civilization, the period since the end of the last ice age. The Earth is warming by around 0.2°C per decade, or even faster. Within a decade or two, Earth could easily exceed the 1.5°C danger limit identified by climate scientists and adopted by the Paris Agreement as the target limit of warming.

Why is 1.5°C so important? Not only will the damages of climate change be very large and globally widespread at that average temperature, but Earth will also be vulnerable to huge and potentially devastating feedback effects. With global warming of 1.5°C, dire risks multiply in several areas:

- a multi-meter rise in the sea level caused by the partial disintegration of the West Antarctic ice sheet
- a dramatic slowing or shutdown of

▲ Wind turbines off the Aberdeen coast, Scotland. Scotland, host for COP26, generated the equivalent of 97% of its electricity demand in 2020 from renewable sources. The country has set a legally binding target of 2045 to achieve net-zero emissions

the ocean (thermohaline) circulation
- a major release of cardon dioxide (CO_2) and or methane (CH_4) from the permafrost or deep sea
- a drying of the rainforests and peatlands, leading to a mega-release of CO_2

To head off these risks the world economy must wean itself from fossil fuels as rapidly as possible, and stop or sharply slash other forms of human-caused greenhouse gas (GHG) emissions, such as the CO_2 released from deforestation and land degradation, the methane released from ruminant livestock, and the nitrous oxide released from chemical fertilizers. Nature-based solutions will be needed as well for a massive restoration of degraded lands and forests in order to recapture CO_2 in soils, forests, and other vegetative cover.

"The behavior among major investors seems finally to be shifting significantly and, in my view, irreversibly given the climate risks and decarbonization opportunities

These things will happen. The question is whether they will happen slowly, fitfully, and inconsistently, or whether they will happen rapidly, decisively, and consistently between now and mid-century. Dozens of governments, including those of many of the largest economies, are adopting the goal of reaching "net-zero" emissions by 2050. That means that emissions of GHGs would be at least offset by the biological storage of CO_2 in restored lands and in the natural reduction of other GHGs from the atmosphere. The question is whether such political commitments will be enough and will be implemented in time.

Let me offer a scorecard on the critical issue of the pace of change. First, the political understanding of what needs to be done has spread rapidly in recent years, but is still far from comprehensive. The European Union's adoption of the European Green Deal in 2019 to 2020 was an enormous breakthrough. It was the first comprehensive program to reach net-zero emissions by 2050 by a major part of the world economy. It was quickly followed by China's commitment to reach net zero by no later than 2060, and by Japan's and Korea's commitments to reach net zero by 2050. The election of Joe Biden as US President put the US into the net-zero group of nations. Now there are dozens. Yet there also remain many governments, including many of major fossil-fuel-producing countries, that still have not signed on to net zero by 2050, including Russia, India, Australia, Indonesia, and the Gulf oil states. We are still far from a decisive global political commitment.

Second, the clarity of how to reach net zero has advanced markedly. While there are still puzzles, the basic pathway to net zero by 2050 is now fairly clear. The UN Sustainable Development Solutions Network has been leading modeling projects since 2014 to answer the question of how to decarbonize, starting with the Deep Decarbonization Pathways Project and in 2020 with the Zero Carbon Action Plan (ZCAP) for the US economy. This year, the International Energy Agency (IEA) issued a comprehensive report on how to achieve net zero by 2050. All of these detailed studies, and dozens more around the world at this stage, point in the same direction.

The pathways to net-zero energy systems include the following:
- zero-carbon power generation, using solar, wind, hydro, geothermal, nuclear (in some countries), and other zero-carbon sources
- electrification of automobiles and some other transport (for example, rail and urban trucking)
- electrification of buildings for heating and cooking
- electrification of some industries
- clean fuels such as hydrogen, ammonia, and synthetic hydrocarbons, produced with the zero-carbon electricity

Puzzles remain, such as the best low-cost technologies for heavy trucks, ocean shipping, and long-distance aviation. But even in those sectors, solutions are in sight.

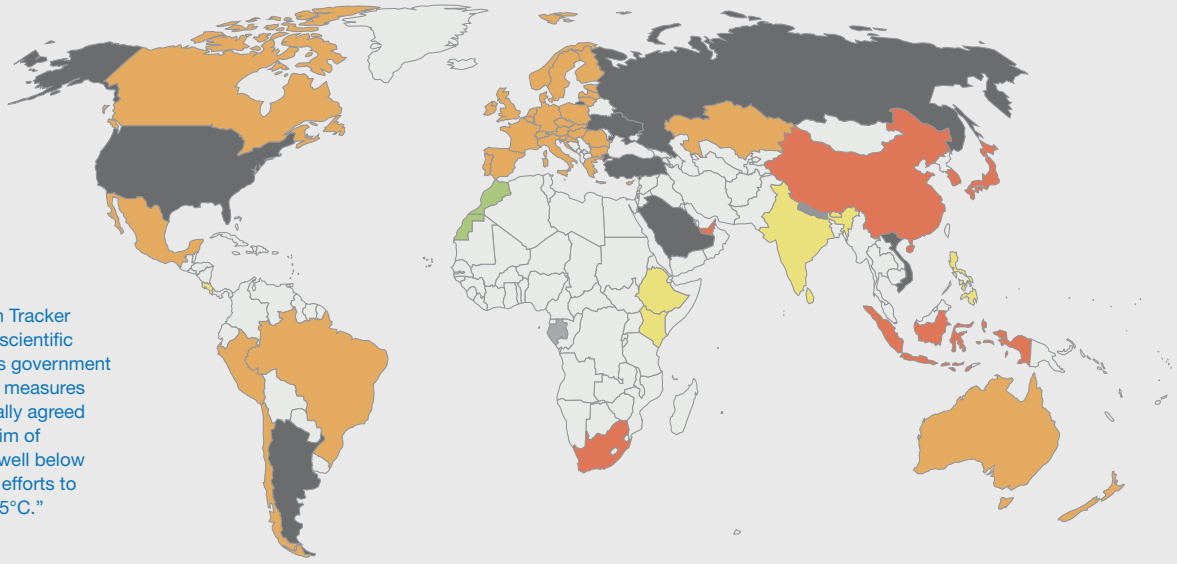
Third, the practicalities of implementing such technology pathways have also dramatically improved because of sharp and continuing declines in the costs of key technologies. Solar power costs continue to plummet, as do the costs of batteries at all scales (for example, for vehicles as well as for grid-scale applications), and offshore wind.

Rapid progress is also being made in advanced materials, energy efficiency, smart grids, electric vehicles, hydrogen production, and other components of a net-zero energy system. Even breakthroughs seem on the horizon for hydrogen-based ocean shipping, and for alternative fuels (such as advanced biofuels and synthetic green fuels) for aviation. The net cost of decarbonizing the US energy system compared with the status quo seems to be well below 1% of GDP per year between now and 2050, and perhaps near zero if the costs of green technologies continue to decline rapidly in coming years, as seems likely.

Fourth, the capital markets are finally beginning to get the message. Until the late 2010s, while scientists and technologists were highlighting the potential of a rapid energy transformation, most Wall Street bankers and money managers were still not shifting their investments decisively towards decarbonization. The big banks continued to pour money into pipelines, oil and gas exploration and development, and even coal. Green rhetoric ran ahead of green investing. ESG investing (that is, investing ostensibly guided by environment, social, and governance considerations)

FIGURE 1: Climate Action Tracker

The Climate Action Tracker is an independent scientific analysis that tracks government climate action and measures it against the globally agreed Paris Agreement aim of "holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C."



was widely regarded as "greenwashing" rather than a real shift of investor action. Yet all of that is changing, perhaps with the defeat of Donald Trump and the Biden administration's commitment to decarbonization.

Since 2020, investor funds are pouring into zero-carbon technologies. Tesla, the electric vehicle manufacturer, has soared in market capitalization far ahead of the incumbent producers of internal combustion engine vehicles. Pipeline projects, oil and gas exploration projects, and fracking projects are being cancelled. There remain considerable new investments in oil and gas, far above what is consistent with a net-zero-by-2050 trajectory. Yet the behavior among major investors seems finally to be shifting significantly and, in my view, irreversibly given the climate risks and decarbonization opportunities.

Fifth, other key stakeholders are now weighing in, shifting the balance of political power against the fossil-fuel industry. For a hundred years, during the 20th century, Big Oil ran the show. Access to oil was considered so vital for national security that Big Oil companies like ExxonMobil and Chevron had seemingly unbounded lobbying power in Washington. Perhaps not surprisingly, these companies epitomized political arrogance. They found it hard to believe that a group of climate scientists and environmental activists could come anywhere close to threatening their financial bottom line.

How quickly now the times are changing. In May 2021, the ExxonMobil management lost a highly contested shareholder vote that put three backers of decarbonization onto the ExxonMobil board. At Chevron, activist shareholders passed a resolution over management opposition calling on the company to cut the GHG emissions from their product mix. The Supreme Court of the Netherlands ordered Shell Oil to slash emissions by 45% by 2030, as part of its duty of care under Dutch law.

The bottom line is therefore the following. With the 2015 Paris Agreement, the world's governments finally adopted a global agreement to try to keep global warming to below 1.5°C. The scientists have indicated that this requires, at the least, that the world reach net-zero emissions by mid-century, and that even with that breakthrough, the limit of 1.5°C warming might still be exceeded. Even after Paris, however, and especially in view of the disastrous Trump administration in the US, actual progress towards net zero by 2050 was scant or non-existent, as global emissions continued to rise, and as big money continued to pour into the fossil-fuel energy sector. Yet all of this is now changing. Governments around the world are adopting the net-zero-by-2050 goal. They are discovering the pathways to action, especially as the costs of the energy transition continue to fall. Investors are now pouring money into clean energy on a massive scale. Key stakeholders, from ESG investors, activist shareholders, and the courts, are weighing in.

This year, 2021, could therefore mark the political and financial tipping point to a clean energy future. All eyes are on COP26 in Glasgow in November, when all of the world's governments assembled together will have the occasion to align on a pathway to decarbonization by 2050. ■

No alternatives to facts

Improvements in technology have made information more accessible than ever. Then why has public debate in recent years been overrun with false narratives, and what can be done?

◂ Nevada, USA, protestors supporting an array of conspiracy theories gather outside the state's legislative building

By Grant Cameron,
Director, SDSN's Thematic Research Network on Data and Statistics (TReNDS)

Today, the information that enables our day-to-day decisions is plentiful and accessible. Before the pandemic, I had a 50-minute commute to work by either bicycle or subway. To decide which mode of transportation was best, I checked the weather app on my phone to see if the daily forecast was conducive for biking. If the weather looked dodgy, I then reviewed the subway app to see if there were service delays. Based on these two sources, I either jumped on my bike or headed to the metro station.

What made me rely on these sources for my commuting decisions? First, the information mattered to my decision. Second, with nearly daily use, I came to trust these sources as reliable. Third, their information was up to date: both sources updated their data and analysis in near real time. Fourth, the data was easily accessible: from the simple touch of my phone, I could easily pull up the apps. Finally, the presentation of the information made it a snap to absorb: their graphs and maps provided a convenient summary of the data. All it took was a glance at my phone to make my decision.

Yet, if reliable and trustworthy information has become easier to consume, why has public debate often been overrun by false narratives? And most recently, what factors contributed to the COVID-19 pandemic becoming an "infodemic": a global outbreak of misinformation?

The data does not fit with what people see or feel

Nobel prize-winning economist Joseph Stiglitz believes that, "if what the expert says has little or no relation to what people feel or can see all around them, it's inevitable that they stop believing the experts and look for answers elsewhere."

The 2008 financial crisis offers a clear example. During this time, gross domestic product (GDP), the standard-bearer for measuring country output, incomes and welfare for over 60 years, continued to grow steadily. But GDP did not reflect that the majority of people were worse off and, in the US, that nearly 91% of the gains went to the top 1%. Moreover, GDP also did not capture that the crisis caused a permanent loss of "hidden capital" in the form of reduced on-the-job training, weaker career prospects for younger workers, and a growing sense of economic insecurity. As some economists relied almost exclusively on GDP to report on the economy's health, people's trust in both the experts and in the statistics was undermined.

// What factors contributed to the COVID-19 pandemic becoming an "infodemic": a global outbreak of misinformation?

The COVID-19 pandemic provides a more recent example of this phenomenon. By July 2020, 45% of the recorded 125,000 COVID-19 deaths were in just four US states: New Jersey, New York, Massachusetts and Illinois. By contrast, 25 states had lost a combined total of 8,000 people, 6.4% of the national total. Four states (Alaska, Hawaii, Wyoming and Montana) had only 80 reported deaths. Although travel between states was never fully restricted, the lack of day-to-day encounters with the disease encouraged indifference in states with a low prevalence of deaths in adopting social distancing and quarantine measures. As a result, a surge in cases and deaths nearly overwhelmed many of these states in the latter half of 2020.

Fortunately, steps are being taken to develop measures that fit better with what people see and feel. For example, the disconnect between GDP and the

true impact of the economic crisis led the Organisation for Economic Co-operation and Development to create a high-level group to develop data sets and tools to examine factors that matter most to people.

And the US Centers for Disease Control is rolling out V-safe, a mobile phone app that collects data on symptoms from the recently vaccinated. Presenting V-safe data in compelling ways will be important for demonstrating to the public how few people are experiencing adverse effects and encouraging greater vaccination take-up among those who remain distrustful of the vaccine.

> ***"Presenting V-safe data in compelling ways will be important for demonstrating to the public how few people are experiencing adverse effects and encouraging greater vaccination take-up among the distrustful***

Fact-checking is not always seen as impartial

The proliferation of false narratives in public discourse has made fact-checking a staple of news reporting services.The New York Times, The Washington Post and the BBC are well-known examples. Recent research tested the impact of fact-checking on public opinion. While it showed that it does indeed improve the public's factual knowledge, increased factual knowledge is insufficient to change policy positions or politicians who support these positions.

One possible reason for this can be attributed to the current state of news media. Media outlets play multiple roles: they report on news as objectively as possible, they fact-check statements made in the public domain, and they provide commentary on these issues. Some researchers have found that the media's multiple roles undermine trust in fact-checking. And the problem has only worsened in recent years as news distribution has shifted from traditional print to digital (online and social media). Digital distribution allows for highly efficient micro-targeting, limiting users to challenge the content.

Further, anyone with a "following" or "klout" can comment on a statement and claim it's incorrect when in reality it's true. Finally, digital media organisations are under so much pressure to get the story out ahead of competitors that they are forced to publish urgently to get the exclusive. Traditional print sources would have had more time to fact-check and validate sources. To combat the spread of misinformation via digital channels, the UN recently launched its PAUSE campaign to encourage social media users to reflect before they share content.

Fact-checking may have more impact if it comes from within the public sector. For instance, the Head of the UK Statistics Authority (UKSA) is legally empowered to call out politicians when facts and figures are misused in reports and speeches. This prerogative works because the UKSA reports to the UK Parliament rather than the Prime Minister and is perceived as an impartial figure.

The UKSA recently made the news when the UK government misled the public over the number of COVID-19 tests it carried out. The UKSA, however, is careful to not overstep. It believes that selective use of factual statistics is part of the political discourse, and careful judgement is applied to determine when selectivity crosses over to misuse or misleading facts.

Information providers need to be upfront about the limitations of their measures

When experts at John Hopkins University created a dashboard and interactive map to track the spread of COVID-19, little did they know that it would quickly become the world's most authoritative source on the latest coronavirus numbers and trends, with the dashboard receiving upwards of 1.2 billion requests daily.

For the US, the dashboard used data gathered by the COVID Tracking Project. Recently, the project's creators described the challenges they faced in compiling comprehensive and reliable data across the US. They observed that, "before March 2020, the US had no shortage of pandemic preparation plans. Many of these plans stressed the importance of data-driven decision-making. Yet these plans largely assumed detailed and reliable data would simply exist."

Unfortunately, this was not the case. The project devoted much effort to adjusting state-level data to ensure that they were comparable at the national level. Had state-level data providers routinely provided metadata (information that describes how and what their data reflect), steps could have been taken before the pandemic to create a consistent set of statistics and allowed policymakers to act sooner.

Doing better next time

The indicators underlying the Sustainable Development Goals have been developed through an inclusive consultative process to ensure that these statistics are policy-relevant and consistently measured by 195 countries. Yet, technical challenges remain to provide numbers for small geographic areas and for vulnerable population groups.

At SDSN TReNDS, we have a mandate to get a range of actors (including statisticians, policymakers, data scientists and lawmakers) to work together to overcome these challenges. The resulting information, we believe, will provide a solid foundation for fighting false narratives on development progress. ■

Prince Sultan Bin Abdulaziz International Prize for Water

Recognizing Innovation

Winners for the 9th Award (2020)

Creativity Prize

Creativity Prize

1) The team of Dr. Benjamin S. Hsiao and Dr. Priyanka Sharma, (Stony Brook University, New York, USA)
for the development of adsorbents, coagulants and membrane materials from sustainable, biomass-sourced nanocellulose fibres along with numerous practical applications that promise to provide effective water purification for off-grid communities of the developing world.

2) The team of Dr. Sherif El-Safty (National Institute for Materials Science, Japan)
for developing novel nano-materials in hierarchal and micrometric monoliths to achieve a nano-filtration/capture/detection process that quantitatively detects and selectively removes a wide range of water contaminants in a single step. A diverse range of these materials, which are conducive to mass-scale production, provides nano-filtration membranes and filters for water management applications, including purification, remediation, and the monitoring of hazard levels.

Surface Water Prize

Surface Water Prize

Dr. Zbigniew Kundzewicz (Polish Academy of Sciences, Poznan)
for advancing our understanding of the relationship between flood risk, river flow, and climate change.

Groundwater Prize

Groundwater Prize

Dr. J. Jaime Gómez-Hernández (Universitat Politècnica de València, Spain)
for pioneering work on solving the "inverse problem" in hydrogeology.

Alternative Water Resources Prize

Alternative Water Resources Prize

Dr. Peng Wang (King Abdullah University of Science and Technology, Thuwal, Saudi Arabia)
for work at the forefront of solar-evaporation water production technology.

Water Management and Protection Prize

Water Management & Protection Prize

Dr. Jay R. Lund (University of California Davis, USA)
for the development of the CALVIN water supply optimization model that couples traditional water-supply criteria with economic considerations.

Nominations are open for the 10th Award. Nominations can be made online until 31 December 2021.

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Lessons from COVID-19

The pandemic has cruelly exposed social inequities and set back progress on the SDGs. But it also gives us critical insights on what must change in our global mission to build a more just, secure, and sustainable future

By Salim S. Abdool Karim, Director, Centre for the AIDS Program of Research in South Africa (CAPRISA) and CAPRISA Professor of Global Health at Columbia University, New York; and Cheryl Baxter, Senior Scientist, CAPRISA; Honorary Lecturer, Department of Public Health, University of KwaZulu-Natal

The COVID-19 pandemic has resulted in immense suffering throughout the world, with over 171 million cases and 3.5 million COVID-19-related deaths reported by 1 June 2021. In many parts of the world, the pandemic is unfolding against a backdrop of overburdened and maldistributed health systems.

COVID-19 has highlighted the importance of resilient health systems that have the capacity for effective surveillance, laboratory diagnostics, contact tracing, and hospitals with adequate beds for patients needing oxygen. A particular challenge was providing high levels of hospital care to thousands of patients with coronavirus, while continuing to treat other communicable, non-communicable, and neglected diseases.

A key lesson in addressing the pandemic has been the dire need for ensuring access to care. Failure to access medical care makes COVID-19 a deadly disease. Coronavirus has put a spotlight on the disparities in access, which has translated to higher levels of preventable death. It is this fault line

◂ COVID-19 vaccination outside the Los Angeles Mission in the Skid Row community, Los Angeles, California. Skid Row is home to thousands who either live on the streets or in homeless shelters. COVID-19 has exacerbated the long-standing inequities between rich and poor, within countries and between countries, with regards to access to prevention and treatment

of how age, race, and wealth impact access to health that has highlighted a key obstacle in the quest to meet the 13 targets and focus on the 28 indicators of SDG 3 (good health and well-being).

A pandemic of inequities

The pandemic has exacerbated several disparities within society. Globally, inequitable access to healthcare has a long history, usually on the basis of affordability. SARS-CoV-2 disproportionally affects older individuals who are at greater risk of requiring hospitalization or dying if diagnosed, with about 80% of deaths being among those 65 years or older.

Despite being the most vulnerable, older people were often denied access to beds and ventilators, based on decisions made around the use of scarce medical resources. Mortality rates in some care homes have been alarming, and several instances of neglect and abuse of the elderly in these facilities throughout the world have been exposed.

The pandemic has also brought social and racial injustice and inequity to the forefront of public health. COVID-19 unequally affects many racial and ethnic minority groups, placing them at increased risk of getting sick and dying from the disease. These racial disparities are evident in several countries and have been extensively documented in the US, where coronavirus has disproportionately affected racial (black or African American, American Indian, or Alaska Native people) and ethnic minority (Hispanic or Latino) groups. These groups are 2.9 to 3.5 times more likely to be hospitalized with COVID-19 and 1.9 to 2.4 times more likely to die from COVID-19 than white people.

In South Africa, COVID-19 mortality in blacks was almost twice the rate in whites. Racial health disparities such as these are frequently aggravated by poverty, which leads to inequitable access to emergency medical care in disadvantaged communities.

COVID-19 has also exacerbated the long-standing inequities between rich and poor countries with regards to access to prevention and treatment. During the early stages of the pandemic, several countries experienced shortages of personal protective equipment (PPE), polymerase chain reaction (PCR) diagnostic kits to identify those who are infected, and cell phone technologies for contact tracing. In April 2020, South Africa was unable to secure adequate supplies of SARS-CoV-2 diagnostic test kits, despite orders being placed and paid for well in advance. Most poor countries were last in line for these precious resources, which were in short supply and high demand across the globe.

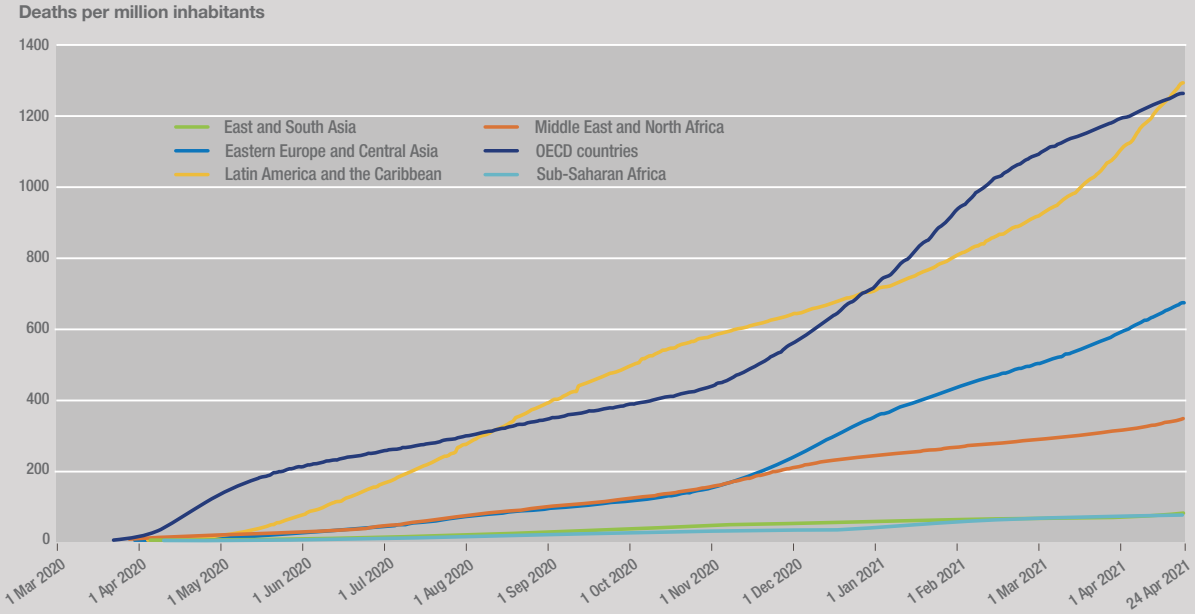
Under this pressure, some innovative solutions were created, such as the African Union's African Medical Supplies Platform. The platform leveraged the continent's collective buying power to become a major purchaser of these essential goods and improve Africa's access to diagnostic kits.

Most concerning has been the inequitable distribution of vaccines. Despite the remarkable achievement of rapidly developing several highly effective SARS-CoV-2 vaccines within a year of the new virus being identified, many poorer countries have fallen behind in the race to vaccinate their populations.

The unequal distribution of vaccines is partly due to limited supplies, but is also due to vaccine nationalism, whereby some countries, particularly those with more resources, adopt a "me first" approach. They have secured more doses than their populations need because they are able to pay higher prices and jump the queue. By 1 June 2021, two thirds of the 1.8 billion vaccine doses that have been administered globally have been given in just six countries (China, the US,

// The African Union's African Medical Supplies Platform leveraged the continent's collective buying power to become a major purchaser of essential goods and improve Africa's access to diagnostic kits

FIGURE 1: Cumulative confirmed COVID-19 deaths per million population (average by region)



Source: Sustainable Development Report 2021. Based on Our World in Data (2021). As of 26 April 2021

India, the UK, Brazil, and Russia), while some countries are only just starting their SARS-CoV-2 vaccination programs.

The world is facing a new, unethical, and immoral situation where young, low-risk people are being vaccinated in one country while those at highest risk, such as healthcare workers and the elderly, have not been vaccinated in other countries. This unconscionable situation is rapidly growing. Israel, which is recovering from its third wave, is vaccinating young, low-risk individuals while many of its neighboring countries have not secured sufficient vaccines for their healthcare workers. In April, all states in the US expanded vaccine availability to young, low-risk people, while at least 10 countries in Africa had not yet secured doses to start vaccinating high-risk healthcare workers.

While COVID-19 is a calamity, it is an opportunity to bolster progress towards universal healthcare

COVID-19 has taken the world off track on its progress towards achieving some of the SDG targets. But it is also an opportunity to draw on the lessons learned during this pandemic to be better prepared for future threats and to achieve a better, more sustainable future.

The reliance of poor countries on others for the development of vaccines and diagnostics highlights the dire need for these countries to increase local investments in science and technology to build self-sufficiency and enhance their capacity to control pandemics.

An important lesson is that preparation and planning fosters health system resilience and saves lives. In general, countries that were able to rapidly implement testing, contact tracing, and quarantining (such as New Zealand) were better able to cope and contain COVID-19.

Some countries (such as Thailand) with experience in dealing with similar respiratory epidemics such as MERS and SARS were also better able to slow the spread of the epidemic. Countries like Rwanda, Ghana, and South Africa creatively pivoted testing infrastructure that had been established over many decades to address Ebola, HIV, and tuberculosis to rapidly scale up SARS-CoV-2 testing. Several African countries also utilized their community health worker programs to carry out widespread screening and contact tracing in the community.

Perhaps the most important lesson has been a reminder of the importance of our humanity and mutual interdependence; each person's actions influence not only their own risk but also the risks experienced by many others, such as their families, work colleagues, and people they share transport with.

Similarly, the spread of SARS-CoV-2 in one part of the world will almost certainly affect other parts of the world. Defeating the pandemic requires global control, which can only be achieved through solidarity among people, communities, and nations.

To be better prepared for future pandemics, the world will need to draw on the lessons learned during this pandemic. Achieving universal healthcare will need to address fault lines in society, foster the importance of collective action, and build solidarity. ■

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Tackling the rise in non-communicable diseases

In current times, it's easy to forget that over 70% of deaths worldwide are due to non-communicable diseases. How can we combat this growing problem?

By Nísia Trindade Lima, President, Oswaldo Cruz Foundation, Ministry of Health, Brazil; and Carlos A. Grabois Gadelha, Economist, Oswaldo Cruz Foundation, Ministry of Health, Brazil

The theory of epidemiological transition (or the changing patterns of population age distributions, mortality, fertility, life expectancy, and causes of death) offers a valuable framework for understanding how different types of diseases can occur simultaneously in a population. However, it can also put too much focus on non-communicable diseases (NCDs), when what is needed is a systemic approach to the social determinants of health.

The same warning applies in the opposite direction: the COVID-19 pandemic cannot disrupt efforts or distract us from the need to ensure access to health and well-being, including promoting, preventing, and treating chronic diseases.

According to the World Health Organization, 41 million people die every year from NCDs, the equivalent of 71% of the world's total deaths. The four NCDs that cause the highest mortality are:

- cardiovascular diseases (17.9 million people a year)
- cancers (9.3 million people)
- respiratory diseases (4.1 million)
- diabetes (1.5 million)

▲ Patients exercise at a COVID-19 quarantine house on the outskirts of Jakarta, Indonesia. Unhealthy diets and lack of exercise are major drivers in the rise of NCDs

As the COVID-19 pandemic has revealed, the global health picture can no longer be characterized simplistically as NCDs impacting developed countries and communicable diseases impacting developing countries. NCDs seriously affect people in low and middle-income countries (LMICs), where 77% of global NCD deaths (31.4 million) occur. These diseases are usually associated with older age groups, but more than 15 million of

all deaths attributed to NCDs occur between the ages of 30 and 69. An estimated 85% of these deaths occur in LMICs.

NCDs are a problem worldwide, affecting countries of different development levels, as made explicit in target 3.4 of the Sustainable Development Goals (SDGs): "By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being."

Reducing deaths from NCDs

Some of the actions needed to achieve target 3.4 are sectoral in nature, such as efforts to increase access to new generations of medicines in LMICs. For example, in many countries, including Brazil, the cost of immunotherapies for cancer treatment is prohibitive, directly affecting access.

Policymakers must recognize this link between price and access and work strategically with the healthcare sector to enable treatments to be scaled up at lower prices, making universal access feasible. Through public–private cooperation, the cost of access can be reduced while increasing opportunities for investment, improving returns on research and development spending, and generating sectorial jobs and income. Cooperation is essential to tackling NDCs, as the case of cancer shows. Without it, innovation will limit treatment to those people and countries who can afford it, leaving many behind.

It is therefore vital that governments and the private sector deal directly and transparently with the issues of price and access by establishing relationships of trust and institutional stability. Nation states can use both carrot and stick, mixing incentives with appropriate regulation, in a process of negotiation with the pharmaceutical industry. This should involve mutual procurement commitments with public and international organizations to enable universal access worldwide.

Current data reveal that, so far, efforts made by countries to face the urgencies posed by the 2030 Agenda have had little effect. Add to this the fact that some of the conditions that contribute to the prevalence of NCDs are linked to the very ways societies are structured, and we have an extremely complex scenario. These diseases are driven by forces that include increasing inequity within countries and globally, rapid unplanned urbanization, globalization of unhealthy lifestyles, and population ageing. Unbalanced diets and lack of physical activity can lead to raised metabolic risk factors such as increased blood pressure, blood glucose and blood lipids, and obesity. All these can lead to cancer, cardiovascular, and other chronic diseases, strongly contributing to premature deaths.

In addition to all the arguments regarding chronic diseases, it should be noted that these conditions do not occur in isolation. The term "syndemics" describes an epidemiological situation in which multiple diseases coexist and progress in synergy. The reality of the threat to life goes beyond the compartmentalized view to which we are accustomed, reinforcing the need to propose solutions from a systemic perspective. COVID-19, for example, is more dangerous among carriers of comorbidities, such as many NCDs.

Integrated solutions

The set of transformations needed to address NCDs goes beyond the field of health. A systemic approach is needed, one that relates well-being to the economy.

In the classical sustainable development view, three worlds need to engage in dialogue: the world of economics, the world of social welfare, and the world of environmental sustainability. We emphasize that health incorporates these three dimensions in an interdependent way. Health is, at the same time, a constituent part of the welfare state, an essential vector of economic development based on innovation capabilities and an integral part of environmental sustainability. It is not just an externality to development or complementary to development. Health is development! It strongly involves science, technology and innovation, local and regional production capability, general conditions of social welfare, and sustainability. All of these determinants conditioned the access to health and the global and national preparedness to face NCDs challenges.

According to the World Intellectual Property Organization's Global Innovation Index 2019, just 15 global companies hold 60% of the patents in biotechnology for the treatment of cancer and other chronic diseases. Patents are indicators of current and, critically, future technological production profiles. Such patent concentration today means more concentration and asymmetry from a production and technology standpoint in years to come. This is not consistent with the 2030 Agenda. It will reproduce inequities in health and in economic development. The SDGs represent a positive global initiative that must involve political decision-making at national and global levels to face these international knowledge asymmetries.

We must address, at the same time, sustainability and access to technologies as two sides of the same coin. This includes a global effort to foster a generation of innovation in less developed countries and link science, technology, and innovation with universal access needs. We need game-changers in incentivizing and regulating innovation, including in the field of intellectual property. The sustainable development agenda can only be achieved if there is a commitment to reduce global asymmetries in knowledge and health production.

This perspective involves a paradigm shift in public policies. We must integrate the world of economics and innovation with the world of well-being and environmental sustainability. ■

The authors would like to thank Marco Nascimento and Karla Montenegro for their help in gathering and organizing information for this article.

Better living through nutrition

Despite the will, many developing countries lack the resources to deal with a problem that ravages at both the national and individual level. We need smarter, context-specific solutions on nutrition that can catalyze sustainable change

By Namukolo Covic, Senior Research Coordinator, CGIAR Programme on Agriculture for Nutrition and Health (A4NH), Ethiopia; President, African Nutrition Society

Malnutrition is a frequently used but less well understood word. It refers to all forms of unfavorable health conditions that result from inadequate diets, or health conditions that cause a person to lose the nutrients they've consumed, for example through frequent diarrhea or vomiting. Undernutrition is a form of malnutrition caused by a deficiency in one or more specific nutrients. It's also possible for an individual to have too little of some nutrients and too much of others. Such imbalances lead to different forms of malnutrition. For example, malnourished children can:

▲ A farmer in the Chencha district of Ethiopia using agroforestry techniques. Planting indigenous tree species to restore the land, the soil fertility is improved and the crops are more resilient to climate change

- be too short for their age (stunted)
- weigh too little for their height (wasted)
- weigh too much for their height (overweight)

Another example is when adults become overweight or obese and develop type-2 diabetes, high blood pressure, or some cancers.

In all these forms of malnutrition, the result is poor health outcomes, often needing frequent or chronic medical attention, at much cost to households and governments. Taking action on Sustainable Development Goal (SDG) 2, to foster zero hunger and prevent all forms of malnutrition, therefore contributes to attaining SDG 3 on promoting good health and well-being, while also reducing health costs.

Governments focus on investing in health systems, medical technologies, training, medical practitioners, and treating illnesses. They give us statistics like the number of doctors or nurses per 1,000 people. Less attention, however, is given to the need for greater investment in nutrition. No matter how much governments invest in health systems, good health will be difficult to attain without good nutrition. Indeed, medication without the right food and nutrients can lead to undesirable complications. Better nutrition that helps to prevent malnutrition is cost-effective.

The cost of malnutrition in Africa

Many low and middle-income countries, including most African countries, face the persistent challenge of high levels of undernutrition, characterized by high prevalence of stunting and wasting.

The 2020 Global Nutrition Report showed that 29% of children in Africa were stunted, with 24 countries having stunting prevalence over 30%. The cost of undernutrition has been estimated across 21 African countries through joint studies of national governments and the African Union supported by the World Food Programme. They clearly show how costly undernutrition can be, ranging from 2% of gross domestic product (GDP) in Egypt to 17% of GDP in Ethiopia.

These are staggering economic losses. If we flip these figures, can you imagine any government investing in something that resulted in a 17% gain in GDP (or 2% for that matter)? It would be an astonishing investment that political leaders would deservedly brag about. But we also know that, due to lack of data, these estimates do not account for the full cost of malnutrition.

To see the full picture, we would need to add the costs of treating other resulting conditions: overweight, obesity, diabetes, high blood pressure, and diet-related cancers. Simply put, malnutrition is expensive for any government.

Malnutrition is also costly from an education perspective. The Cost of Hunger in Africa studies have associated up to 18% of school repetitions (pupils having to repeat a school year) to stunting. Another estimate was that stunted children completed up to four fewer years of school, undoubtedly reducing economic earning potential in adulthood.

Malnutrition can therefore be a curse: not just for health systems but also in how it limits people's potential to attain decent work and constrains economic growth (both targets under SDG 8). Malnutrition also makes SDG 1 (on poverty eradication) difficult to achieve. In fact, malnutrition can limit the attainment of at least five SDGs (1, 2, 3, 8, and 10) while being impacted by 10 SDGs. And of course, this in turn means SDG 17 is critical to ensure coordinated and aligned actions among all relevant stakeholders.

Scaling up nutrition

Finance ministers must assess the losses accrued as a result of not investing in nutrition. The efforts of the African Leaders for Nutrition Initiative, implemented by the African Development Bank and the African Union to promote investment in nutrition, are therefore commendable.

This initiative has coined the phrase, "investing in Africa's grey matter infrastructure" by governments. This refers to the negative impacts of malnutrition on children's brain development, limiting earning capacity in adulthood. It would be highly desirable to see African governments dedicate fixed percentages of national GDP to nutrition. Why not? Malnutrition is eroding national GDP year after year, like a leaky tap whose losses can only be stopped by investing in nutrition.

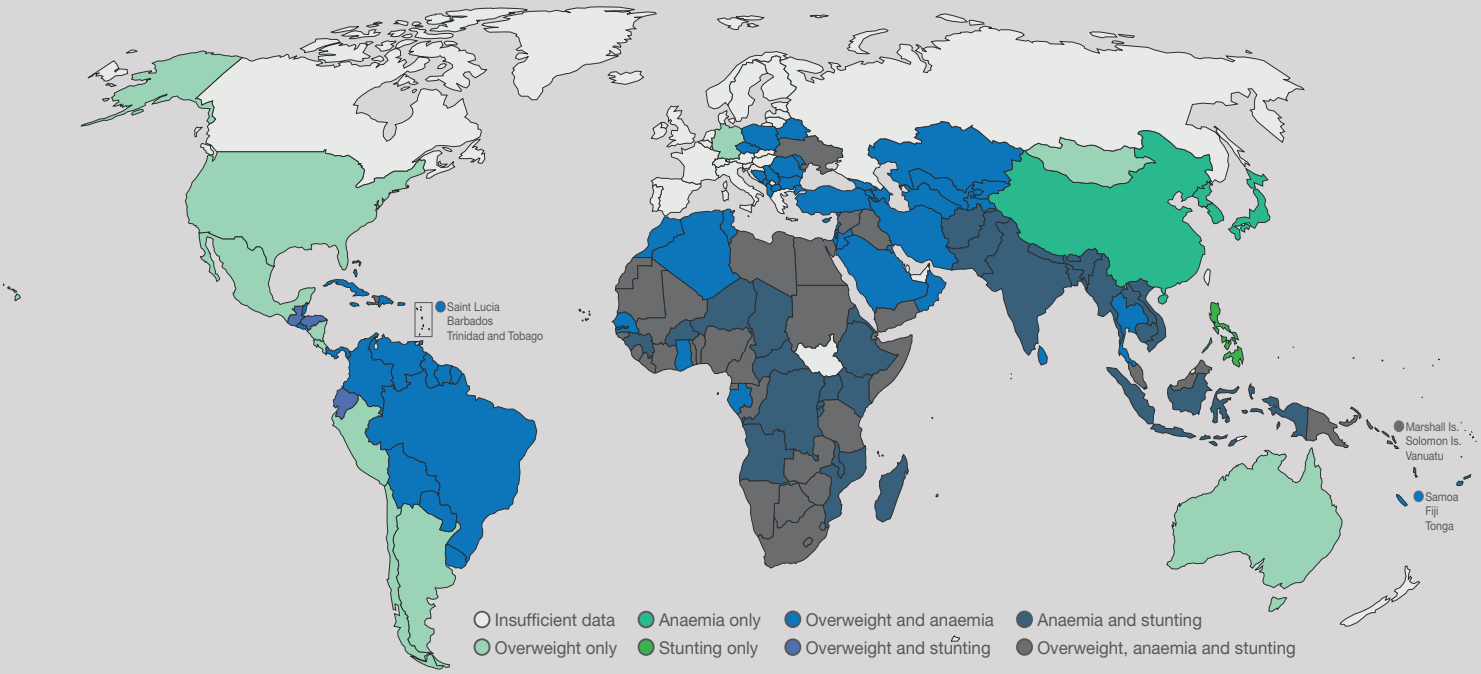
So, what does investing in nutrition really mean? What should national and development partner budgets be allocated to?

> ***"Many African countries have an enhanced nutrition policy environment, but unfortunately struggle to effectively implement them at scale due to resource constraints***

Today, 41 of the 54 African Union member states are part of the SUN (Scaling Up Nutrition) Movement, and many have over time developed policies targeting nutrition in some form. Many African countries, therefore, have an enhanced nutrition policy environment, but unfortunately struggle to effectively implement them at scale due to resource constraints. This calls for finance ministers to review the intended actions of existing policies towards providing regular and predictable funding for:

- nutrition services
- coordination structures and mechanisms across different government sectors and at different administrative levels, from national to community level
- better training and deployment of enough nutrition professionals to implement programs effectively

FIGURE 1: Map of countries with overlapping forms of stunting in children under 5, anaemia among women of reproductive age, and overweight in adult women



Source: UNICEF/WHO/World Bank Joint Child Malnutrition Estimates Expanded Database: Stunting, Wasting and Overweight, (March 2019, New York), NCD Risk Factor Collaboration 2019, WHO Global Health Observatory 2019.

Yes, countries face resource constraints, making prioritization a must. Prioritization must target catalytic actions for a given country context. Answering the question, "what would be catalytic in a given context?" is critical and must be informed by available evidence. If the evidence is not there, investing in research is essential. Otherwise, targeting the most catalytic actions becomes a challenge, leaving countries unable to get the most from the limited resources available and losing out on potential catalytic momentum. Similarly, development partners must seek to be catalytic in their actions. This would be "investing smart."

The ongoing United Nations Food Systems Summit 2021 process is a welcome effort and potentially catalytic for nutrition.

The Lancet Commission Report of 2019 rattled us with recommendations that called on people everywhere to collectively consider the food choices they make, not just for nutrition but also for long-term food security and planetary sustainability. It warned that ignoring the impact of our food systems on the environment, from production to consumption, would not be wise. What would be the consequence for future food security? Should African countries be worrying about the environment when so many still face significant food insecurity?

These questions bring us to the SDGs on managing and protecting life in water and on land (SDGs 14 and 15), adopting responsible consumption patterns (SDG 12), ensuring affordable and clean energy (SDG 7), and climate action (SDG 13). By addressing these SDGs, we protect future food security and nutrition.

African countries cannot afford to ignore the environment. Doing so would limit our ability to sustain food security and nutrition over time. Africa is already experiencing significant climate variability with frequent droughts and floods in some settings. Nuanced action is needed.

For example, many countries need to increase consumption of animal-derived foods to address nutrient deficiencies. Yet they also need to increase productivity of different foods including the animal derived foods, while adopting best practices to manage soil and water; mitigate against biodiversity loss and environmental damage; and limit climate change. Meeting the nutritional needs of Africa is not only about people today but also about future generations.

It makes good sense to invest in nutrition and the food system that delivers it. The benefits are many, and not doing so is a cost we must not entertain. ■

© UNDP Afghanistan

Universal healthcare post-COVID

With the pandemic demonstrating that "no one is safe until everyone is safe," the case for universal health coverage has never been clearer. How do we achieve it?

By K. Srinath Reddy, President, Public Health Foundation of India; Co-Chair, SDSN's Thematic Network on Health For All

Health systems and economies around the world have been challenged as never before by COVID-19. Even as countries wage battles to counter and curb this threat, there are concerns as to whether the pandemic will undermine or alter global commitment to the Sustainable Development Goals (SDGs) or delay

◂ Nurses training in Jalalabad, Afghanistan. After graduation, these nurses will help bring healthcare to some of the country's most disadvantaged and inaccessible regions

the attainment of targets to far beyond 2030. Of particular concern is the vulnerability of target 3.8 on universal health coverage (UHC).

Concerns about the feasibility of vigorously pursuing the UHC agenda during the post-COVID recovery are misplaced. The pandemic underscores three clear messages on health systems. First, if a swift and strong response has to be mounted against a public health emergency, countries must have an efficient and equitable health system, well established and competently functioning in a steady state. Second, comprehensive primary care must form the foundation of such a health system. Third, if countries do not invest in a well-resourced health system focused on UHC, their economies will keep slipping on the banana skins of unanticipated or poorly handled public health emergencies.

Indeed, the historical evidence of the last 75 years shows that those countries which did invest in health and ushered in plans for UHC during or immediately after a crisis reaped rich dividends in health gains and economic growth.

Wide-ranging gains

UHC is the hallmark of a society that invests in the health of its people not only because it makes sound economic sense but also because it recognizes health as a human right that must be respected and protected. Economic gains from investments in health are wide-ranging. They include the increased productivity of the population and reduced healthcare costs for averted or abbreviated illness.

Gains also arise from expanded employment opportunities in the health sector, and the social stability of a society that is not severely challenged by physical and mental health disorders. The right of an individual to lead a healthy life must not be undermined by failures of the health system to prevent, recognize, or effectively care for an illness. UHC is a solemn affirmation of social solidarity, which is the most ennobling attribute of an advancing civilization.

UHC requires that all essential health services be available to every person, based on need and with assured quality, without anyone suffering financial hardship. This means that UHC must greatly reduce the risks of high out-of-pocket expenditure (OOPE), catastrophic health expenditure caused by episodes of illness that are expensive to treat, and healthcare-related descent into poverty.

Since it is not possible for all countries to immediately meet all of these requirements, the World Health Organization (Figure 1) recommends a path of progressive universalization, in the form of a cube with three dimensions:

- population coverage
- service coverage
- cost coverage

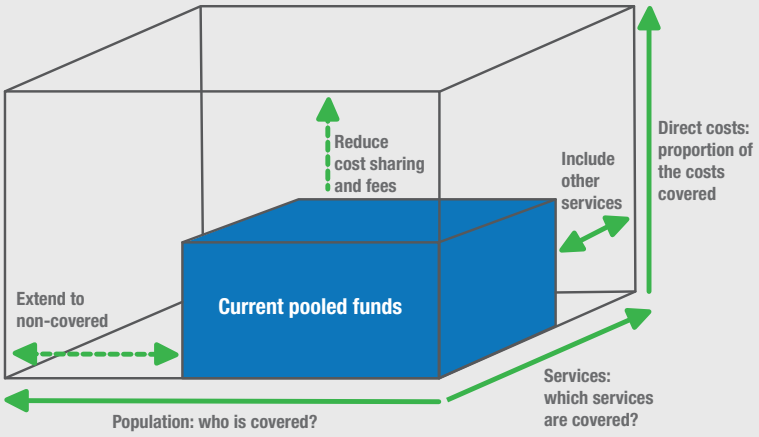
At each stage of the evolution of UHC, based on the resources available, priorities set in each of these dimensions must be reconciled to meet the health needs of the population. An essential health package, delivered through periodically revised standard management guidelines, becomes the vehicle for delivering UHC.

Since financial resources are always finite, the choices of service package components must be guided by their cost-effectiveness (how much health is gained for the money spent) and extended cost-effectiveness (how much financial protection is also provided to people).

Equity too must play a major role in balancing priorities. "Horizontal equity" ensures that all people are entitled to a

// Economic gains from investments in health are wide-ranging. They include the increased productivity of the population and reduced healthcare costs for averted or abbreviated illness

FIGURE 1: The World Health Organization recommends a path of progressive universalization, in the form of a cube with three dimensions



Source: World Health Organization

common package of services. "Vertical equity" seeks to address the needs of vulnerable groups (such as children and disabled people) and bridge existing health equity gaps that have been created by income, gender, geographic, or social disadvantages. This is addressed through additional services or resources. While such targeting may be accommodated within UHC, the overall program must remain universal.

Primary healthcare (PHC) should be the major delivery vehicle of UHC. It is truly universal in population coverage, as everyone needs primary care services sometime in their life, from childhood vaccination to therapeutic and rehabilitative services for the elderly. PHC provides the broadest package of services and is also the most cost-optimizing. Since outpatient health services over many years contribute to high OOPE, UHC packages which prioritize PHC will reduce poverty. Provision of essential medicines, free of cost, must be assured.

PHC is not highly doctor-dependent, as community health workers and technology-enabled allied health professionals can provide many of the required services in rural and urban primary care. By engaging community participation, it democratizes the health system and makes it directly accountable to citizens.

Strengthening every component

Other components of the health system too need be strengthened, to provide advanced care when needed. Even as secondary and tertiary care facilities are strengthened, they must be bi-directionally connected to primary care, which must be the pivot that operates the health system.

While governments must remain the guarantors of UHC, they need not be the sole providers. They may engage private and voluntary healthcare providers, as per need and opportunity, but must create the architecture and regulatory systems within which they operate as partners providing contracted UHC services with accountability. A strong public-sector healthcare delivery system will help to set cost and quality standards for UHC.

The quality of healthcare services too must be measured. Are they beneficial? Are they safe? Are they cost-optimizing? Do they provide satisfaction to recipients, their families, and providers? As a number of innovative health technologies offer themselves in a rush to impress, these questions must form part of their assessment, even as existing health services are subjected to periodic technical, financial, and social audits.

Financing of UHC must be mainly through tax-based public financing. Contributory health insurance, through payroll deductions (labor taxes), are not a feasible option in low and middle-income countries with a high proportion of informal workers, and poor families with low incomes. Even if employer-provided insurance and private insurance are additional sources of financing, a single-payer system that channels all funds will create a large risk pool, provide the purchaser the power to negotiate cost and quality standards and enable an expanded service package.

A capitation fee system is more efficient than a fee-for-service mode of purchase of services from care providers. Ultimately, UHC has to operate on the principle of cross-subsidy, where many healthy people subsidize the fewer sick people at any one time, and the rich subsidize the poor through a progressive tax system.

Apart from health financing, all other elements of the health system too must be assured. They include:

- adequate infrastructure at all levels of care
- a multi-layered, multi-skilled health workforce
- uninterrupted supply of essential drugs, vaccines, and technologies
- accurate and time-sensitive health information systems
- community engagement
- good governance and administrative efficiency

The social, environmental, and commercial determinants of health too must be addressed, both through coordinated planning at a policy level and convergent service delivery at the primary-care level.

As the post-pandemic period dawns, we must build forward broader, better, and fairer. PHC-led UHC lights up that path to our collective future. ■

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Spending smarter on health

The pandemic shows the critical importance of robust health systems, and that bigger budgets alone are no guarantee of "success." Achieving good health and well-being for all by 2030, while restoring public finances, will need cost-effective spending on health

By Zulfiqar A. Bhutta, Founding Director, Centre of Excellence in Women and Child Health, Aga Khan University, Karachi; and Jai K. Das, Assistant Professor, Division of Women and Child Health, and Section Head, Section of Public Health and Epidemiology, Aga Khan University, Karachi

Higher investment in health correlates with better health outcomes. This is often represented by the Preston Curve (Figure 1, overleaf), which shows the correlation between economic growth (per capita gross domestic product) and life expectancy. However, the curve also shows that this correlation is not linear. Life expectancy in several low and middle-income countries (LMICs) for a given level of GDP per capita is better than others.

And, as the COVID-19 pandemic demonstrates, some of the so-called highly developed countries with extensive per capita health expenditure have had abysmal health outcomes. There have been wide disparities in COVID-related morbidity and mortality in these countries' populations, disproportionately affecting the socially marginalized and disadvantaged. Many LMICs have also seen their economies devastated and health systems severely strained.

▲ Neonatal care in Kirehe District Hospital, Rwanda. The country has made remarkable gains in public health over the last two decades

Good health and well-being are among the top priorities for individuals and nations alike. As defined by the World Health Organization over 50 years ago, "health is a state of complete physical, mental, and social

well-being and not merely the absence of disease or infirmity." This was a promise reinvigorated more than 40 years ago in the Declaration of Alma-Ata. The declaration identified primary healthcare as the key to promoting and protecting health for all, deemed essential to ensure sustained human, social, and economic development.

However, the health of a population is not determined solely by health systems, but is greatly influenced by the so-called social determinants of health. These are "the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life."

These forces and systems include economic policies and structures, development agendas, social norms, social policies, and political systems. We can also add the influence of factors such as climate change, environment, and living conditions, and how these factors overlap with conflict and displacement or migration. Recognizing the interconnectedness of these drivers underpins the Sustainable Development Goals (SDGs) and their interdependence.

Resourcing UHC

A recent analysis of the status of implementing the health and health-related SDGs, both globally and in a representative sample of countries, suggests that effective implementation would require appropriate organization and oversight structures, as well as attention to the principles of universal health coverage (UHC).

There are wide disparities in health access and coverage globally. Some 3.6 billion people do not get the most essential health services they need and some 100 million are pushed into poverty from paying out of pocket for health services. COVID-19 has made this even more difficult. Few LMICs will meet their targets for UHC and health and poverty-related SDGs without adequate resources, and so must take urgent steps to strengthen their health-financing situation.

The concept of public health financing has been increasingly recognized globally for many decades. In 2005, members of the World Health Organization pledged to develop health-financing systems so that all people have access to services.

Today, the expanded repertoire of interventions necessary to achieve UHC requires fiscal space (budgetary room for governments to provide resources for health without undermining fiscal sustainability). In the wake of the COVID-19 pandemic and its consequent fiscal pressures, investment in UHC must not be at the expense of the gains made in maternal, newborn, and child health and nutritional interventions. Worryingly, such reversals are already being observed.

Yet there are also clear examples of countries mobilizing domestic resources and financing to make UHC a reality. Rwanda is a remarkable example of an African country that was able to lift itself from the ashes of a terrible genocide and achieve remarkable gains in public health over the last two decades.

True and equitable UHC is not achievable without well-functioning and efficient public health financing, and innovations such as health insurance and conditional cash transfers. This is especially relevant for LMICs as healthcare expenditures have grown rapidly in recent decades with the advent of powerful new treatments. Spending is set to rise further with the inclusion of non-communicable diseases within UHC packages of care.

Global healthcare expenditure as a share of world income has been increasing steadily in recent years, as the health sector continues to expand faster than the economy (although it slowed after the financial crisis of 2007 to 2008). In 2018, global spending on health was USD 8.3 trillion or 10% of global GDP. The picture between countries, however, is highly variable. The average health expenditure in low-income countries was just USD 41 per person in 2017, more than 70 times less than in high-income countries, at USD 2,937 per person. Indeed, the top 1% of spenders account for more than 20% of total healthcare spend.

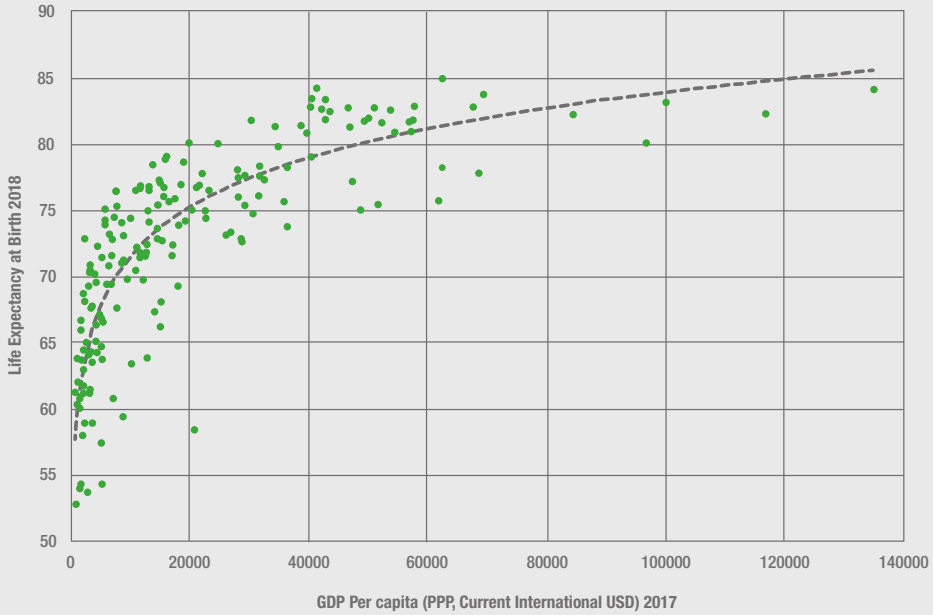
Health expenditures in LMICs, though lower, may be proportionally greater in relation to GDP. And, unfortunately, in many instances health spending in these countries is regarded by governments as an expense rather than an investment. There are also huge disparities within countries, as health access is low in difficult-to-reach or thinly populated areas.

In many countries, healthcare financing is comprised mainly of public and private funding. This includes government budgets, compulsory or voluntary prepaid insurance schemes, direct out-of-pocket payments by users, and external aid. Healthcare spending is usually focused on infectious diseases in developing countries and accounts for over half of those countries' overall health spending. In developed countries, meanwhile, non-communicable diseases account for about 30% of healthcare spending.

Health spending from external aid reached its peak in 2014 and has since fallen. Most external aid is being absorbed by middle-income countries and in recent years has surpassed that of low-income countries. As the health sector expands it becomes less reliant on out-of-pocket spending. Total out-of-pocket spending doubled in LMICs

"True and equitable UHC is not achievable without well-functioning, efficient public health financing, and innovations such as health insurance and conditional cash transfers

FIGURE 1: The Preston Curve – life expectancy relative to income



Preston Curve: T. Freeman, International Journal for Equity in Health

from 2000 to 2017 and increased 46% in high-income countries, but this growth has been slower compared with public spending across all income groups.

Getting more bang for the buck

Despite the multiple initiatives and global agendas, most LMICs have yet to seize the growth and development opportunities offered by high-performing health financing and cost-effective healthcare. The focus of these strategies should be to scale up preventive and promotive interventions, which would lead to falls in the cost of treating disease.

Evidence suggests that simple solutions for newborn health, immunization against preventable childhood diseases, and micronutrient treatments remain among the most cost-effective and affordable interventions for maternal and child health. Community-based approaches should be further explored in LMICs, as they could both increase outreach and decrease cost per person covered.

Current international collaborations must increase the support to LMICs, especially to countries suffering conflict and humanitarian emergencies. At the same time, developing countries must focus on removing inefficiencies to reduce waste of already limited resources, as an estimated 20% to 40% of health expenditures are wasted. Such LMICs must couple more money for health with more health for the money. Increases in development and health budgets must be accompanied by improved tax revenues from tax evaders.

There is evidence that developing countries with higher tax revenues tend to have higher healthcare expenditures. This is an important determinant of progress towards UHC. Reducing waste and inappropriate use, as well as focusing on prevention rather than acute episodic care, have the potential to dramatically improve the effectiveness of healthcare expenditures and thus reduce the need for additional financing. The efforts should be on:

- increasing efficiency by identifying and focusing on priority areas
- improving the use of technology
- improving the quality of services by better equipping and training health personnel
- putting in place strong monitoring and evaluation systems with independent audits

The world must realize the need for inclusive growth. What better time to learn than now, with the pandemic threatening to leave lasting economic scars and set development back years, if not decades? COVID-19 has a devastating impact on health systems globally. Nearly all countries have responded to the crisis with exceptional budget allocations, but with the health sector receiving a smaller portion.

We need to emerge from this crisis better and fairer and with stronger inter-sectoral collaborations. Academic and development partners must work together to define cost-effective packages of care, as well as innovative financing solutions that also address the underlying determinants of health.

There is an urgent need for a global collaborative effort, with development partners, national governments, businesses, and civil society working together to deliver the SDGs by 2030. ■

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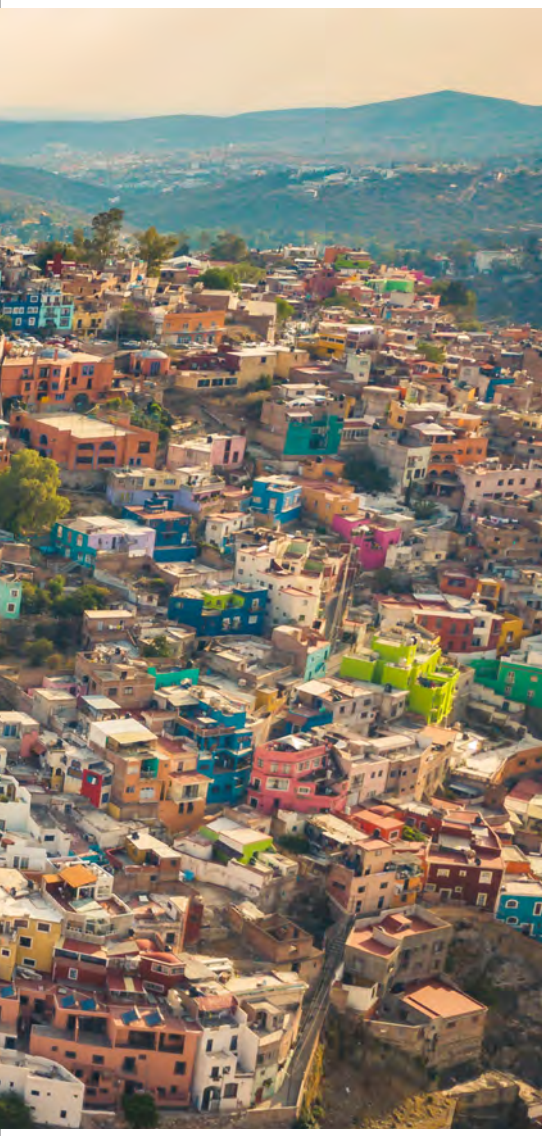
Building a more equal world

Coronavirus threatens to push already damaging levels of inequality to new extremes. Post-pandemic, we must go beyond lifting people out of poverty and tackle the deeper structural causes of inequality at all levels

By Max Lawson, Head of Inequality Policy, Oxfam International

The coronavirus crisis swept across a world that was already extremely unequal. A world where a tiny majority of over 2,000 billionaires, mainly men, have more wealth than they could spend in a thousand lifetimes. A world where nearly half of humanity was forced to scrape by on less than USD 5.50 a day. A world where the richest 1% has consumed twice as much carbon as the bottom 50% for the last quarter of a century, driving climate destruction. A world where the growing gap between the rich and poor both built on and exacerbated age-old inequalities of gender and race.



◂ Guanajuato, Mexico. Latin America has been the region most heavily impacted by COVID-19. The region is one of the most unequal in the world, with high levels of poverty and crowded living conditions. Mexico has suffered a case-fatality rate of 9.4%, with over 230,000 deaths as of June 2021

According to the World Inequality Report 2018, between 1980 and 2016 the richest 1% received 27 cents of each dollar from global income growth. This is more than twice that of the bottom 50%, who only secured 13 cents of every dollar. If the economic system is left to distribute the fruits of growth so unevenly, it will never eliminate poverty. It is also completely unsustainable.

Analysis of the origins of the wealth of the world's richest shows how much of it is unearned. Oxfam has calculated that two thirds of billionaire wealth only exist because of inheritance, economic monopolies, and crony connections to government. Inheritance simply creates a new aristocracy, and monopolies and cronyism are signs of a dysfunctional economy, not a functional one. It's an economy that makes life more expensive for ordinary people.

This inequality is the product of a flawed and exploitative economic system, which has its roots in neoliberal economics and the capture of politics by elites. It has exploited and exacerbated entrenched systems of inequality and oppression, namely patriarchy and structural racism, ingrained in white supremacy. These systems are the root causes of injustice and poverty. They generate huge profits accumulated in the hands of a white patriarchal elite by exploiting people living in poverty, women, and racialized and historically marginalized and oppressed communities around the world.

Inequality's harm

Inequality has multiple impacts on humanity and human progress. The International Monetary Fund (IMF) recently found that in countries with higher income inequality, gaps between women and men in health, education, labor market participation, and representation in institutions like parliaments are also higher. The gender pay gap, where men earn more than women, was also found to be higher in more unequal societies.

Those living in unequal societies are less happy, less healthy, less educated, live with more crime and violence, and live shorter lives. It leaves many more people living in fear and many fewer in hope.

In the first months of the pandemic, a stock-market collapse saw billionaires, who are some of the biggest stockholders, see dramatic reductions in their wealth. Yet this setback was short lived. Billionaires had recovered almost all the money they had lost within eight months. Their fortunes have continued to increase since then.

At the same time that the greatest economic shock since the Great Depression began to bite, the virus saw hundreds of millions lose their jobs and face destitution and hunger. This in turn is set to reverse the decline in global poverty we have witnessed over the last two decades. It is estimated that the total number of people living in poverty could increase by between 200 and 500 million. The number of people living in poverty may not fall back to its pre-crisis level for over a decade.

The virus exposed the fact that most people on Earth live just one paycheck away from penury. They live on between USD 5 and USD 10 a day. They rent a couple of rooms for their family in a slum. Before the crisis hit, they were just managing to get by, and starting to imagine a better future for their children. They are the taxi drivers, the hairdressers, the market traders. They are the security guards, the cleaners, the cooks. They are the factory workers.

The virus has shown us that for most of humanity there has not been a permanent exit to poverty and insecurity. Instead, because of inequality and the hoarding of the proceeds of growth by the richest, at best there has been a temporary and deeply vulnerable reprieve.

While it is too soon to have the full picture, most initial studies point to a significant increase in inequality. The IMF, World Bank and Organisation for Economic Co-operation and Development have all expressed concern that, left unchecked, the coronavirus will drive up inequality. The fact that the virus has impacted economically on every country on the planet at the same time, means it is likely that almost every nation will see an increase in inequality. That is something never seen before in history.

This view is supported by Oxfam's survey of 295 economists from 79

countries around the world, where 87% of them projected that there would be an increase or major increase in inequality in their country in the next two years.

Governments face a choice

An increase in inequality is almost certain. Yet the extent of this increase, and the speed with which it is reduced and greater equality achieved, is in turn the choice of governments across the world. The World Bank has shown that if leaders choose to act to reduce inequality, we could return to pre-crisis levels of poverty within three years.

Conversely, if governments allow inequality to increase, the number of people living in poverty by 2030 will still be higher than it was before the virus hit. If governments seek to reduce inequality, 900 million fewer people will be living in poverty by 2030 than if inequality is left to increase.

In 2015, all governments agreed for the first time to reduce inequality, as Sustainable Development Goal (SDG) 10. This was a historic moment. It was also agreed that the fight must be against inequality in all its forms. The gap between rich and poor undermines progress on education, health, and gender equality. More equal societies are societies that are more likely to be able to meet all of the SDGs.

Since then, progress in the fight against inequality has been painfully slow. Oxfam's Commitment to Reducing Inequality index (CRI), which surveys 158 countries, shows most governments are failing to set clear goals and put plans in place to reduce the gap between rich and poor.

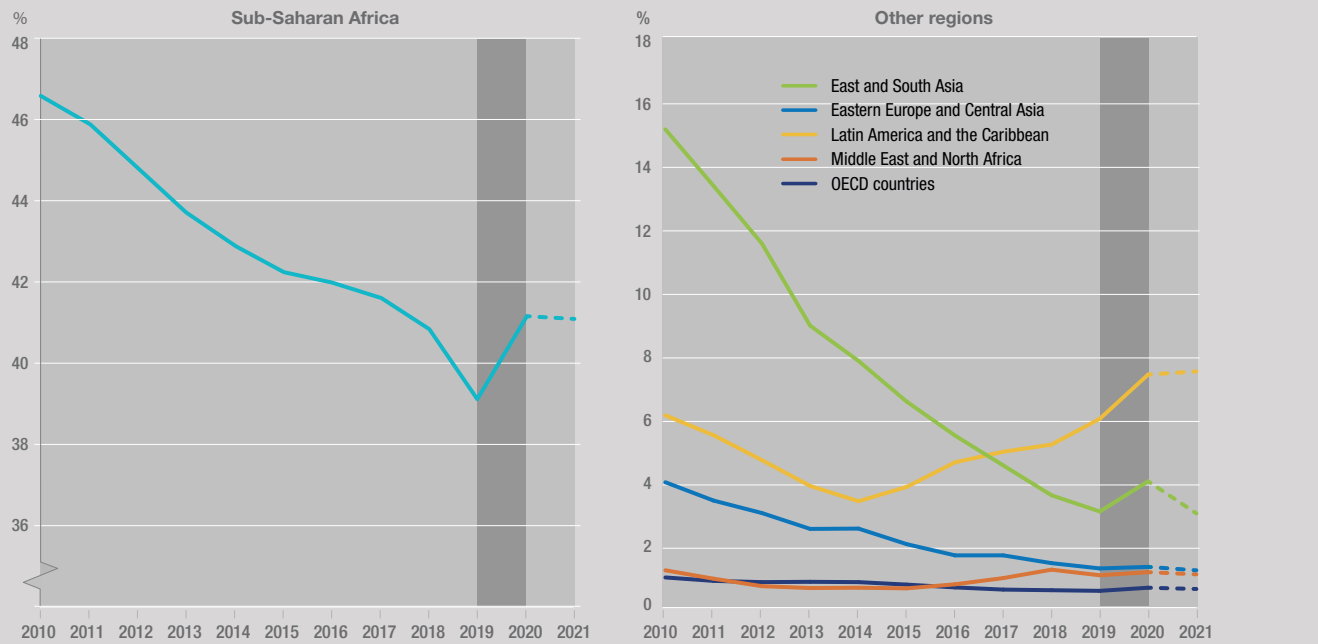
The good news is that this inequality is not inevitable. Clear, concrete steps can be taken by governments of all income levels to reduce inequality. South Korea has increased taxation of the richest, increased the minimum wage dramatically and introduced universal social protection. Sierra Leone has introduced free secondary education and increased taxation of mining corporations. Some governments have also taken dramatic steps to protect their populations in response to coronavirus. Bolivia has scaled up cash transfers by 322% to cover 97% of the population. Ecuador and Argentina have increased taxation on the richest to help pay for the recovery.

To reduce inequality, governments must dramatically improve their efforts on progressive spending on key public services like health, education, and social protection. They should increase progressive taxation, including taxation of wealth. They should increase workers' pay and protection. These measures should be done as part of national inequality reduction plans under SDG 10, setting clear, time-bound targets to reduce the gap between rich and poor.

Sadly these countries are the exception, not the norm. The majority of nations are simply failing to do what they can do to reduce inequality.

Coronavirus offers us a vital opportunity to imagine and build a more equal world. We must not waste it. ■

FIGURE 1: After years of progress, extreme poverty increased in several regions in 2020



Source: Sustainable Development Report 2021. Based on World Data Lab (2021)

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Equality for women

The pandemic is negatively impacting women more than men, by exacerbating already entrenched inequalities. We need bold, transformative action to dismantle the barriers to women's progress if we are to achieve SDG 5 by the end of the decade

By Phumzile Mlambo-Ngcuka, UN Under-Secretary-General and Executive Director of UN Women

More than 25 years after the landmark Fourth World Conference on Women in Beijing, true and lasting equality for women remains in view but not yet in our grasp. Though we have seen important gains, such as decreases in maternal mortality and improvements in girls' education, overall progress has been too slow and too piecemeal. The COVID-19 crisis has also shown us that progress can be frighteningly reversed.

The pandemic has rapidly exacerbated existing gender inequities. Violence against women has risen, and women have suffered higher adverse economic impacts and job losses. This has been caused both by increased unpaid caregiving and the fact that women work in more insecure, low-paid and informal job settings. COVID-19-related school closures have heightened the effects of the gender digital divide and have put nearly 10 million more girls at risk of child marriage this decade. All of this is posing a direct challenge to the achievement of the Sustainable Development Goals (SDGs).

▲ In-person schooling resumes in Bandung, Indonesia. COVID-related school closures, increasing demand for unpaid caregiving, have widened gender inequalities. An extra 47 million women are forecast to fall into extreme poverty this year

Shifting course

Despite these almost ubiquitous challenges, there are positive solutions that we can apply to steer our societies and economies out of the disastrous impact of COVID-19 and into constructive change. These solutions require recognition of some previously underestimated underlying barriers, which the pandemic stressors have brought to light.

Governments' decisive commitment to gender-responsive stimulus packages that truly respond to women's needs will be critical. Several governments have already taken unprecedented measures, such as strengthening access to healthcare and providing cash transfers, paid sick leave and unemployment benefits.

Yet while some of these measures will benefit women, far too few are being designed or implemented with women's rights or needs in mind. As the UN Development Programme/UN Women COVID-19 Global Gender Response Tracker shows, only 18% of the global social protection and jobs response so far have targeted either women's economic security or addressed the rise in unpaid care work.

Current forecasts are that without a change in course, an additional 47 million women will be pushed into extreme poverty this year, overturning decades of progress. This would be a stunning reversal for the SDGs, but this kind of backsliding is not a foregone conclusion: with bold policies to boost women's economic empowerment, we can shift course and accelerate progress instead.

Generation Equality

We look to governments and to those who have power, resources, and influence to become the champions of what we call Generation Equality. We need new Commitment Makers to shape a future that dismantles the barriers to women's progress by working across generations and sectors and on priority issues.

I invite all countries, businesses, civil-society organizations, young people, and allies to join Generation Equality's Global Acceleration Plan. The plan convenes collective action through "Action Coalitions" which are centered around six themes:

- gender-based violence
- economic justice and rights
- bodily autonomy and sexual and reproductive health and rights
- feminist action for climate justice
- technology and innovation for gender equality
- feminist movements and leadership

The targets that support the themes are intended to guide action and investment for the next five years. For example, the pandemic has confirmed that care for children and other family members is essential, life-sustaining work and there is a need for investments in both public and private quality care services.

It also requires the creation of new, well-paid, and safe care jobs that recognize, reduce, and redistribute the current unpaid care work in homes, and that reward care workers and guarantee their labor rights. In turn, such changes need an enabling legal and policy environment.

Canada has recently promised significant fiscal resources to achieve affordable childcare for all, by specifically committing to improving the pay and conditions of care-sector workers. The United States' Biden administration has recognized that care is infrastructure, alongside roads and bridges, and has pledged investments of USD 400 billion.

Every country should have and implement gender-responsive macroeconomic plans, budget reforms, and stimulus packages, including quality public social protection floors and systems so that the number of women and girls living in poverty is significantly reduced. Now is the moment for other leaders to follow suit to support the care economy and champion women's economic justice and rights to the rest of the world.

A pandemic of inequities

Even before the pandemic, women's employment was often concentrated in the most vulnerable informal jobs. During the pandemic, women have lost their jobs at a faster rate than men. This has had particularly devastating consequences for the economic autonomy of women with care responsibilities. Labor market vulnerabilities are even worse for the most excluded, including women with disabilities, migrant and refugee women, and small farmers.

In recent studies, lost income and employment, food insecurity, and substance abuse has been linked to increased risk of men's violence against women and girls, exacerbating the prevalence of domestic and other forms of violence. Young women aged between 15 and 24 years are often the worst affected. There are well-grounded fears that other forms of violence, such as female genital mutilation and child marriage, are also on the increase.

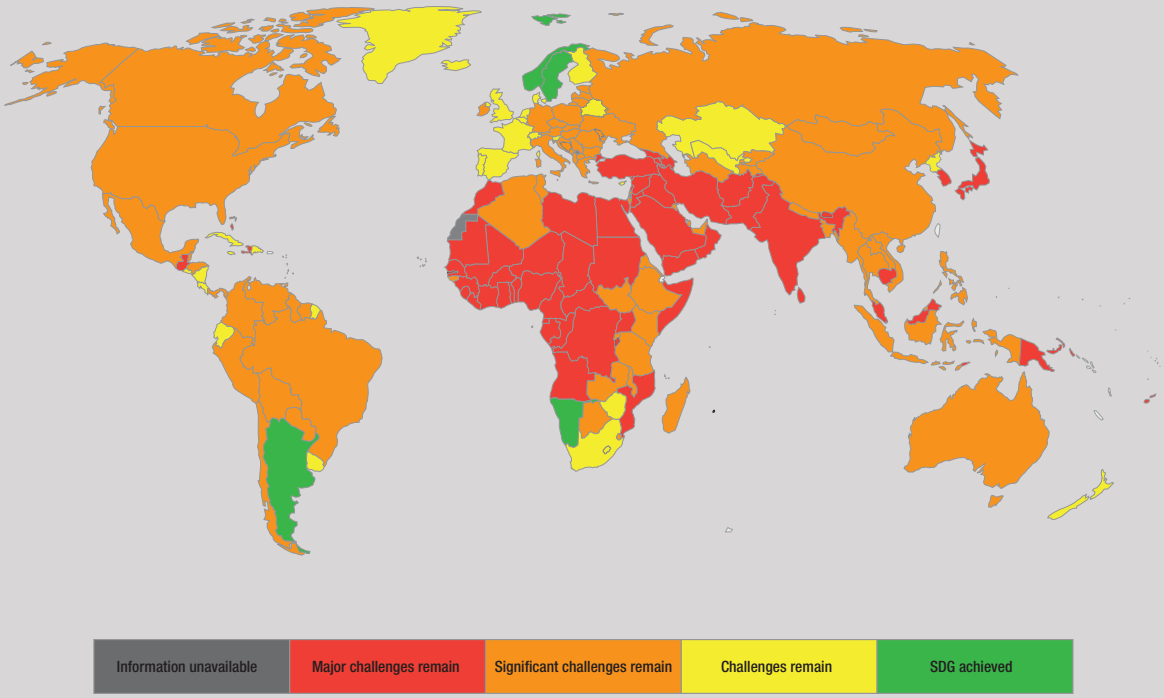
I urge all stakeholders to join the Global Acceleration Plan to:

- tackle gender-based violence and commit to ratify international and regional conventions
- scale up implementation and financing of evidence-driven prevention strategies
- scale up implementation and financing of survivor-centred, comprehensive, quality, accessible, and affordable services for survivors

// A new global minimum tax rate proposed by the UN would help to stem the tide of tax evasion and avoidance. It would ensure that everyone makes a fair contribution to the kind of world we want for the next generation

FIGURE 1: A global view of gender inequality

Results for SDG 5 (Gender equality) from the Sustainable Development Report 2021, tracking countries' performances on women representation in parliament, equality in years of education received, access to reproductive health, and labor force participation



Source: Sustainable Development Report 2021

- support women's rights organizations, activists and movements, including those working to address gender-based violence against women and girls in all their diversity

Generation Equality also includes a Compact on Women, Peace and Security and Humanitarian Action. This calls for the acceleration of full, equal and meaningful participation of women in security institutions, among other key leadership, protection, and financing goals.

While progress has been achieved, particularly in civilian leadership where women now comprise 41%, a UN Women analysis estimates that at current rates it will take 30 years to reach gender parity for military troops in the UN.

I invite Member States, regional bodies, civil-society organizations and networks, young women peacebuilders, and those working in humanitarian and crisis settings and the private sector to join the Global Compact. I invite them to support the sustainable deployment and meaningful participation of uniformed women peacekeepers, so that security institutions become representative, responsive, and accountable to all.

We need bold, transformative action

There is hope if we change course. But hope is not a strategy. At a critical moment in this Decade of Action, these and the other elements of the plan will help us rethink, renew, and revolutionize how we organize our societies and economies.

Progress will also depend on generating much-needed financial resources, especially for developing countries. There have been significant calls to the International Monetary Fund (IMF) to issue special drawing rights. These will provide emergency funds for developing countries to pay off unsustainable debt, fund vaccines, or invest in social protection for their people. Meanwhile, a new global minimum tax rate proposed by the UN would help to stem the tide of tax evasion and avoidance. It would ensure that everyone makes a fair contribution to the kind of world we want for the next generation.

Crises of the magnitude we face today call for big, bold ideas and extraordinary levels of global solidarity and cooperation to implement them. The Generation Equality Action Coalitions bring together the broad range of actors needed to drive progress forward. Together, we must aim towards a more sustainable and just future, to ensure prosperity for all and realize the 2030 Agenda. ■

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Achieving the just transition

The phasing out of fossil fuels must be fair to all, including those communities dependent on polluting industries. Yet policies to achieve this "just transition" remain weak and scattered. What must governments do to strengthen them?

By Robert Pollin, Distinguished University Professor of Economics, and Co-Director, Political Economy Research Institute, University of Massachusetts-Amherst

Considered as a full package, the Sustainable Development Goals (SDGs) establish a powerful and broadly unified program for raising average global living standards, reducing poverty, and protecting the environment. At the same time, some tensions do inevitably arise in advancing these combined purposes of the SDGs. It is critical that we recognize where these tensions exist since it is the only way through which we can resolve them effectively.

One crucial area in which unavoidable tension arises is with the massive global industrial transition in the world's energy system that must occur so that the global economy can move onto a viable climate stabilization path. This issue lies at the heart of at least four of the goals, including SDG 7 (affordable and clean energy), SDG 8 (decent work and economic growth), SDG 9 (industry, innovation, and infrastructure) and SDG 13 (climate action). The new energy system must be highly efficient and powered by clean renewable sources, primarily solar and wind power. This is because, on a global scale, roughly 70% of all carbon dioxide (CO_2) emissions come from burning oil, coal, and natural gas to produce energy. Reducing these CO_2 emissions, in turn, is the most critical factor in addressing climate change.

The economic rewards for the transition to a sustainable energy system are overwhelmingly persuasive. The investments that will be needed to build a global clean energy system (averaging about 2.5% of global gross domestic product (GDP) per year until 2050) will be a major engine of job creation throughout all regions of the world. On average, these investments will generate in the range of 160 million jobs that will be sustained throughout the 30-year transition period. This amounts to about two to three times more jobs than if we continued to invest in maintaining our existing fossil fuel-dominant energy system.

However, what is frequently overlooked is the scale of disruption and economic loss that will be inflicted on certain parts of society. To take effective action on climate stabilization, the global economy's currently fossil

◂ Pit water management at a former coal mine in the Ruhr Valley, Germany. The policies and initiatives deployed in the region to transition to clean and sustainable alternatives are a good guide for how to approach the transition from fossil fuels

fuel-dominant energy system needs to be phased out completely over the next 20 to 30 years. Worldwide, the fossil fuel energy system employs approximately 40 million people. Without intervention, the transition will act counter to the SDGs, creating winners and losers, and heightening inequality.

Workers and communities throughout the world whose livelihoods depend on the production of oil, coal, and natural gas, will, without question, lose out in this clean energy transition if we do not manage to create a just transition for them. It is not an exaggeration to say that the fate of the planet depends on it.

This is not purely a matter of doing what is right and fair, it is pragmatic and necessary to facilitate the transition. Without such programs, the workers and communities facing retrenchment from the global fossil fuel phase-out will fight to defend their communities and livelihoods. This in turn will create dangerous delays in advancing effective climate stabilization policies.

What support is needed?

One approach to mitigate the harm and smooth the transition is to focus on direct support for the workers impacted. Consider the US economy. Recent work that I have done with co-authors estimates that the rough average costs of a just transition program for displaced workers would be a relatively modest USD 3.1 billion per year. That is less than 0.01% of the likely average US GDP from 2021 to 2050. This level of funding would provide strong support in two areas:

- guaranteeing both pensions and new jobs, at pay levels equal to their fossil fuel jobs, for laid-off workers
- high-quality retraining and relocation support as needed

Of course, other countries will need to mount comparable programs.

The second, equally critical, area for just transition in the global energy industry is reinvestment and general support for communities that are, at present, heavily dependent on the fossil fuel industry. These communities will face formidable challenges adapting to the fossil fuel industry's decline. One obvious set of projects would be to clean up and reclaim the land surrounding abandoned coal mines as well as oil and gas production sites.

Another is land repurposing. A prominent case of successful repurposing has been the experience in Germany's Ruhr Valley, the traditional home for Germany's coal, steel, and chemical industries. Since the 1990s, the region has advanced industrial policies to develop new clean energy industries. As one important example of this repurposing project in the Ruhr region, RAG AG, a German coal-mining firm, is in the process of converting its Prosper-Haniel coal mine into a 200-megawatt pumped-storage hydroelectric reservoir that acts like a giant battery. The capacity is enough to power more than 400,000 homes in North Rhine-Westphalia. This example shows that political will, together with strict regulations, can put in place feasible transitions, even in fossil fuel hotspots.

Execution is everything

Recognition that governments must support industrial transition and commit investment is not enough in itself. Successful programs of this kind are rare. For decades, the much more common experience, both in the energy industry and more generally, has been transition programs that have been largely ineffective in delivering meaningful results for impacted workers and communities.

In the US the Trade Adjustment Assistance (TAA) program, which was first enacted in 1962, is a conspicuous example. The purpose of the TAA, as its name implies, is to assist US workers whose jobs have been displaced due to rising import competition. The TAA is designed to provide extended unemployment insurance benefits, supplemental income for displaced workers moving into lower-paying jobs, retraining support, health benefits, and allowances for job searches and relocation. In reality only a small minority of workers who lost jobs in manufacturing received support from the program; most had to rely on Social Security and disability benefits.

On a global scale, a 2017 study by the Organization for Economic Co-operation and Development's Just Transition Centre concludes by emphasizing that, to date, only minimal progress has been achieved in implementing successful transition policies in the energy industry and other high CO_2-emitting sectors, such as cement. The study emphasizes the "absence of appropriate government policies, funds, and structures for just transition." It argues that "without more assertive and coherent action from governments, we risk seeing many more examples of transition that do not deliver justice, resulting in stranded workers and communities."

Making the commitment

Germany's successful transition in the Ruhr Valley resulted because policymakers were committed to providing sufficient resources to support the project. Government policies delivered in supporting workers with income supplements, retraining opportunities and active assistance in finding new job opportunities. Government policies also provided significant financial subsidies for private clean energy investors. Without significant subsidies, many, if not most, of the Ruhr Valley's major clean energy projects would have entailed excessive costs or risks for private investors.

What should therefore be clear is that just transition policies for both workers and communities need to be recognized as a first-order policy priority on a global scale – including commitments of adequate financial resources to support these policies – for the SDGs to fully deliver on their enormous promise. ■

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Cities as vanguards for action

The future of our planet and its people rests significantly on cities. This decade, we must transform how cities operate to drive global efforts on sustainable development, climate action, and recovery from COVID-19

By Maimunah Mohd Sharif, Executive Director, United Nations Human Settlements Programme (UN-Habitat)

Cities are now on the frontline of almost all the global agendas that will either accelerate humankind's achievements or speed up our collective demise. A decade ago, the world shifted irreversibly from being mostly rural to mostly urban. Today 55% of the global population lives in urban areas. This is projected reach to 68% in 2050, with the urban population increasing by 2.3 billion. While cities exert a huge economic pull, their ecological impact on their surroundings can be devastating. Cities now generate 80% of the world's economy, and most countries that have urbanized have experienced the benefits of economic growth. The problem is that not everyone is benefiting in equal measure.

There is a notable trend of increased social inequality that corresponds with urbanization. Inequalities occur between urban and rural areas, between urban centers, and between neighborhoods. It is not uncommon to have slums existing alongside affluent communities.

In 86% of countries with data, studied for the UN's World Social Report 2020, income inequality was found to be higher within urban areas than within rural areas. Some of the qualities that make city life so exciting can also breed inequality.

Spatial inequalities

Human activities generate wealth. The more concentrated wealth becomes, so particular areas of the city receive more investments than others. This phenomenon, often termed as spatial inequality, is a consequence of certain locations benefiting more than others in their access to economic opportunities and infrastructure investment.

◂ Wohnprojekt Wien, Austria, a sustainable, collaborative housing association, incorporating social housing. Cities can be planned and managed in a way that meets positive social, environmental, economic, and cultural outcomes

Inequality of outcomes in cities plays out in various global agendas as follows:

Migration

Cities offer economic opportunities, refuge, and basic services. They have served as destinations or places of transit for most migrants and refugees. According to the UN High Commissioner for Refugees, cities now accommodate 60% of the world's refugees. Despite migrants generating 9.4% of global gross domestic product, migrants and refugees frequently face social exclusion and poverty in cities. Here national and regional governments have an important role to ensure that systems of small and large cities, not just the major cities, can accommodate population growth sustainably, and local governments have an important role to support economic and social integration, and thus facilitate the many positive impacts of migration in cities.

Climate change

Cities are at the heart of the climate agenda. Production, unsustainable construction, and carbon-heavy energy and transportation contribute to cities generating 70% of global greenhouse gases. As spatial inequalities prevail, informal settlements, often built on steep slopes and floodplains, are highly vulnerable to climate-induced disaster. Cities thus need to be at the heart of the forthcoming debates at the UN Climate Change Conference (COP26) in Glasgow.

COVID-19

Due to their economic activity and interconnectedness, cities became epicenters for the spread of COVID-19. By mid-2020, 90% of cases were recorded in cities, and local measures to mitigate the spread profoundly impacted local economies. UN-Habitat's recent Report on Cities and Pandemics highlights the fact that unplanned, densely populated urban communities, without commensurate infrastructure, have been "weak spots" with greater prevalence and risk.

Peace

The inequalities experienced in cities can be stark. It was the desperate act of an urban informal market vendor in 2010 that sparked the "Arab Spring," and its impact is still being felt over a decade later. It is also notable that unemployed urban youth became recruitment targets for extremist groups. As urban dynamics play an increasing role in conflict, it is high time to reflect on the impacts and cost of prevailing inequalities.

Sustainable development

Around two thirds of the global Sustainable Development Goal (SDG) targets have urban dimensions. SDG 11 (sustainable cities and communities) is closely interconnected to all the other SDGs. It has a particular bearing on poverty alleviation, gender equality, productivity, and access to health, education, water, and clean energy.

Cause for optimism

While this tension between economic development and social inequality prevails, and for as long as economic priorities compromise environmental sustainability, cities will have a mixed impact on the achievement of global agendas. It has long been acknowledged that the battle for sustainable development will be won or lost in cities.

There is, however, reason for optimism. The agendas outlined above are interconnected. Cities, being a human construct, can be planned and managed in a way that meets positive social, environmental, economic, and cultural outcomes. Cities are recognizing their importance as vanguards of sustainable development. An important trend has recently emerged where cities are holding themselves to account on this by publishing their Voluntary Local Reviews. Through these, cities undertake a critical analysis of their performance in achieving the SDGs and can commit to priorities for measurable action to accelerate their achievement.

The New Urban Agenda provides a blueprint on how the transformative potential of cities to drive sustainable development can be harnessed. Cities must be governed in a way that engages all people, groups, and communities. E-governance plays a welcome role in including people and stakeholders in decision-making processes. Particular efforts are needed to engage the urban poor and others that are traditionally excluded, including women, youth, and elderly people. Cities can also be planned with principles of compactness and connectivity, which when complemented with equitably distributed basic infrastructure and services, can drive economic development while also protecting the environment and biodiversity.

When cities are planned and managed well, they can be vanguards for inclusivity, shared prosperity, climate change mitigation and adaptation, peace, and a green, just, economic recovery from COVID-19.

UN-Habitat has developed with the United Cities and Local Government (UCLG) guidance on Voluntary Local Reviews so cities can critique and share their experience.

Related to this, the recently launched SDG Cities Global Initiative helps cities connect urban data to strategic planning, to the identification and financing of high-impact projects while also building the key capacities and systems needed to achieve the SDGs. Through its array of digitalized tools and partnerships with national authorities, local government associations, academia, civil society, and private-sector investors, it aims to impact on 1,000 cities and a billion lives.

The decade ahead is a critical moment for our cities. UN-Habitat has recently launched its New Urban Agenda illustrated handbook and e-learning course that can guide city leaders, and local and national institutions to plan and manage cities in a way that drives sustainable development. ■

Greening older buildings

While regulations for new buildings are improving sustainability, the vast majority of existing properties predate these rules. How can we "fix" older buildings?

By Alexei Trundle, Research Fellow, Connected Cities Lab, University of Melbourne

Over the 15-year lifespan of the Sustainable Development Goals (SDGs), the world's urban population is projected to increase by nearly a third: from 3.98 billion in 2015 to 5.17 billion by 2030. Over the next decade alone, 789 million people are expected to be added to our cities.

In recognition of the immense scale of ongoing global urbanization, a significant effort has been committed to the greening of new building stock through design, technological innovation, incentives, accreditation, and regulation.

These initiatives have the potential to transform much of the world's urban environment. However, most city dwellers depend upon existing buildings and associated infrastructure, which generally predate sustainability-focused changes to construction and design processes.

Underscoring the scale of this "inherited" challenge are recent findings by the UN Environment Programme that the operation of existing building stock was responsible for an estimated 28% of global energy-related CO_2 emissions in 2019. This is before accounting for the global construction industry, which adds a further 10% to the share of emissions contributed by the building sector.

Sustainable urban (re) development and the UN

While the need to construct better new buildings is therefore critical, it's equally important to understand how the global community can retrofit our existing human settlements to be more sustainable. To do so we must first consider where the built environment fits within the global sustainable development agenda.

In any such analysis, due consideration must also be given to differences in not only built form and urban governance but also, as importantly, the socio-cultural conditions from which cities emerge, and should ultimately be designed to support, at a local scale.

The negative impact of cities and buildings on global environmental sustainability has been recognized by the international community for the better part of half a century. The declaration that resulted from the first United Nations Conference on Human Settlements (Habitat I) in Vancouver in 1976 recognized the detrimental "environmental impact of human settlements." The concern was that "uncontrolled urbanization" was resulting in "overcrowding, pollution, deterioration, and psychological tensions" in major urban areas.

These viewpoints were expanded two decades later at the second such global conference on urban development, Habitat II. There, it was declared that profound changes to patterns of consumption and production were necessary "prerequisites for sustainable human settlements development."

It was not, however, until Habitat III, held in Quito, Ecuador in 2016, that cities and the built environment were recognized as critical, positive "drivers of sustainable development in an increasingly urbanized world." Despite hopes that Habitat III, and its outcome document The New Urban Agenda, would reinvigorate interest in cities by the global development community and UN Member States, its implementation has broadly remained subsidiary to the more clearly articulated 17 SDGs (and associated targets and indicators) contained within the UN's 2030 Agenda for Sustainable Development.

Although the 2030 Agenda includes a much-lauded "urban" goal (SDG 11), there is little direct reference to buildings, construction, urban design, and built form, either within its 10 targets or elsewhere across the 17 Global Goals. Only one out of the full suite of 169 SDG targets refers to buildings and materials (target 11.c), and only for consideration in the context of least developed countries.

Both "design" and "construction" do not rate a mention in the resolution's text. Sustainable urban development is primarily referenced in the body of the 2030 Agenda in paragraph 34. This focuses responses to the "negative impacts of urban activities" through consideration of hazardous chemicals, waste management, and water and energy efficiency.

The greening of existing buildings is therefore primarily able to be addressed through key targets across the other 16 SDGs, attributes that are subsequently embedded within design considerations, guidelines, and standards. SDG 7, for instance, which focuses on affordable and clean energy, includes targets and indicators for improving energy efficiency and investment (targets 7.3 and 7.b). National and municipal governments, and even private utilities, have generated a diverse suite of approaches for supporting household and commercial building energy retrofits globally (see the 2018 State Energy Efficiency Scorecard).

The continuing rapid reduction in photovoltaic (PV) solar panel costs,

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▲ The informal settlement of Karail in Dhaka, Bangladesh, viewed from the more affluent Gulshan district

coupled with differing government feed-in tariffs, subsidies, and targets, has resulted in the integration of rooftop solar at a household scale across a diverse range of urban environments. This addresses both SDG 7 as well as targets within SDG 13 (climate action). In countries typified by low-density suburbia, such as Australia, this has resulted in some local government areas having more than half of all households with grid-connected solar systems. In the Global South, uptake of off-grid panels coupled with batteries for use in lighting, charging devices, heating, and cooking is also transforming urban informal settlements. In the process, this is leading to co-benefits in poverty reduction (SDG 1), education (SDG 3), and decent work and economic growth (SDG 8).

Beyond the regulated city: leaving no settlement behind

Government regulations and incentives continue to play a critical role in regulating, incentivizing, and guiding the greening of older buildings. However, it is also important to recognize that more than one billion urban dwellers reside in informal settlements. These are areas that generally operate outside of formal governance structures, rules, and legislation. Even within formal areas, it is often poorer households that lack the financial capacity to improve their residences or are constrained or disincentivized from direct investment by tenancy arrangements. With the centerpiece of the 2030 Agenda being to leave no one behind, it is critical that national and subnational efforts to improve our existing built environments account for these spaces and the people that inhabit them.

Informal settlements can already show us many innovative forms of sustainable urban living and green built form design. We just need to be more willing to consider, engage with, and learn from their inhabitants. Widespread urban gardening in the informal settlements of Pacific Island cities, for example, provides community governance mechanisms that could be replicated not only in the formal domain, but also by cities in the Global North trying to accelerate urban agriculture. Efficiencies in resource reuse, community recycling, and creative redesign of public open space for cultural practices all offer sustainability solutions that are often not able to be tested and demonstrated within the strict confines of regulated governance.

The world is traversing the second year of the Decade of Action on the SDGs while it struggles with the ongoing impacts of a global pandemic. It is clear that we must draw upon not just the deep interconnections across the different fields of knowledge that relate to sustainable urban development, but also on the diversity of innovative solutions across the world's cities and settlements.

In building back better, we must also rebuild and reconfigure our existing cities. Only then can our urbanized planet transition into a genuinely socially, environmentally, and economically sustainable "new normal." ■

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Towards emission-free mobility in cities

For cities of the future, the car will not be king. Redesigning cities to promote sustainable and safer forms of transport must start now

By Alejandro Saniger, Professor, National Autonomous University of Mexico

So how did we get to this point? The 17th century saw the birth of steam-powered vehicles, although steam-powered cars never really took off. It wasn't until the 19th century that internal combustion and electric engines were used in cars. At the beginning of the 20th century, Henry Ford's mass production assembly line combined with an international oil boom opened the door to car-centric urban development.

Private cars are attractive for many reasons. They provide door-to-door traveling, offer protection from environmental conditions, and in many cases are a social status symbol. But

◂ The recently launched Cableway public transport system in Mexico City, Mexico. With 2.3 million vehicles in Mexico City's metropolitan area, it has been ranked as the 13th most congested city in the world. Its average traffic speed of 13.9 kph during peak times is slower than a bicycle

they are particularly inefficient when it comes to road space consumption per passenger, quickly congesting cities and demanding big-scale road infrastructure. This is not only expensive to build and maintain, but is in constant conflict with more sustainable means of transport like walking or cycling.

The combination of road congestion plus emissions from internal combustion engines has caused air quality to plummet in many cities around the world, leading to health problems and premature deaths. Traffic accidents, meanwhile, killed 1.35 million people around the world in 2018, many of them pedestrians and cyclists, according to figures from the World Health Organization.

Curbing car use

The Netherlands was one of the first countries to react against the negative effects of excessive car use. The country's vehicular traffic grew enormously in the 1950s and 1960s thanks to postwar economic growth, but so did accidents and pollution. In 1971 3,300 people died in traffic accidents, 400 of them children. Thus began a series of social protests. Government and social groups worked together to design streets that were more friendly to vulnerable road users. The 1973 oil crisis quadrupled the cost of oil, which also worked in favor of these policies.

Other countries took a little longer to react against car growth. Until the 1990s, many cities followed a policy of "predict and provide": build all the road infrastructure that vehicular traffic would demand to avoid congestion. Then, as the 90s began, some countries identified that this policy was unsustainable. Instead, they began to switch to a policy of "predict and prevent" to start to manage traffic demand. This new vision led the City of London to implement the Congestion Charge in 2003, with private vehicles having to pay to enter the city center to reduce congestion. Singapore had had a similar scheme in place since 1975, upgrading it in 1998 with a system that could read vehicle number plates automatically.

Congestion charge schemes have since been complemented with other ways of managing vehicular access in city centers. These include limiting parking spaces (especially free, on-street parking), and introducing pedestrian-only streets and dedicated bus and cycle lanes.

Safe and inclusive road design

In this sense, a safer design for the different users and uses of the road began to be promoted. Measures like limiting speeds, introducing exclusive lanes for sustainable transport modes, better pedestrian infrastructure, narrowing lanes, reducing vehicle turning radii (to slow vehicles down), and concepts like "superblocks" (large areas in a city within which there are no major roads) became common elements of the transport planning portfolio, even when this meant reducing vehicle capacity. Many of these measures can be seen in different city planning blueprints, like the design guides produced by the National

Association of City Transportation Officials.

Active and electric mobility

Lithium batteries, with their higher energy density, have enabled many new applications, from mobile phones to electric vehicles. Their cost has decreased significantly in recent years, and that trend is expected to continue. Many developed countries have announced bans on internal combustion engine cars as early as 2030.

However, some important challenges for electric vehicles remain:

- cost
- range limitations
- charging infrastructure
- battery life
- battery reuse, recycling and disposal

Given the characteristics of electric mobility, it makes sense to think of it for smaller vehicles, as these obviously require smaller batteries. This, together with higher energy efficiency, also would mean fewer requirements for charging infrastructure and far fewer batteries to dispose of at the end of their lifetime. Smaller and slower vehicles would also bring far fewer deaths from traffic accidents.

The International Transport Forum defines "micromobility" as a form of transport using vehicles weighing less than 350 kg with a maximum speed of 45 kph (limiting kinetic energy to a maximum that is 100 times less than a car at full speed). This definition is interesting because as well as bicycles and scooters, it also includes microcars (although most are around 400 to 500 kg including battery, such as the Microlino, Renault Twizy and Citroen AmiOne).

When compared with traditional bicycles, e-bikes have two significant advantages. First, they help increase average trip length. Some studies have found average trip lengths increasing from 6 to 7 km on traditional bicycles to 10 to 11 km on e-bicycles, a rise of 50% to 60%. That means that a higher percentage of trips already made in the city could be made by e-bicycles. Second, they allow a wider group of users to consider cycling as an option – for example, those who may not want or be able to pedal using human power alone over longer distances. Cargo e-bikes are also an attractive alternative for "last mile" distribution in urban areas.

Urban regulation can go a long way to promoting these kinds of vehicles, particularly in city centers.

> *"Many countries and cities are working to improve urban air quality and promoting the use of cleaner vehicle technologies. An effective way to do it is by implementing low emission zones (LEZs)*

Low-emission zones

Many countries and cities are working to improve urban air quality and promoting the use of cleaner vehicle technologies. An effective way to do it is by implementing low emission zones (LEZs), where access to most polluting vehicles is restricted or deterred. This can be done by, for example:

- charging an access fee
- banning polluting vehicles
- restricting access at certain times of the day (when congestion is higher)
- restricting access on days when pollution levels are higher

Examples of this exist in many cities around the world. Mostly they are in Europe, but also in China, Hong Kong, and Japan.

Internalizing the cost of vehicle use

Car use externalizes many of its costs. This is the case for air pollution, accidents and congestion, where the whole of society pays for a portion of society's car usage. Externalizing costs leads to a higher demand than what would be socially efficient. Congestion charging is one tool that tries to internalize at least part of these costs to bring down car travel demand to more efficient levels.

In general, there is consensus among specialists that congestion charge schemes are positive for promoting more sustainable and equitable mobility. However, it has been challenging to implement these schemes both socially and politically, particularly because of the charges' regressive nature: they hit lower-income car drivers relatively harder than higher-income drivers. But then, this has always been the case with car usage. For more than a century, cars have improved accessibility for higher-income groups while making it more difficult for lower-income groups (by having to move around without a car in cities that have been shaped for cars).

Congestion charging is likely to enjoy better social acceptance if other measures to support equitable mobility are introduced at the same time, such as:

- making public transport less polluting and more efficient
- improving urban safety for pedestrians and micromobility
- better infrastructure to support multi-modal travel, such as convenient park-and-ride facilities

Achieving long-term change

Cities are slowly but surely being shaped by the transport systems that exist within, and are in constant development with, them. For almost a century, a car-oriented transport system has dominated city design, in many cases generating a dependency for it.

Changing land-use patterns takes time. But sustainable transportation policy needs to persistently push to obtain results. If urban mobility policy changes every time a government changes, it will be difficult to achieve progress for the long term. ■

Case study: towards carbon-free transport in Mexico City

In Mexico City's metropolitan area (the ZMVM), according to the 2017 Origin-Destination Survey, 22.3% of people traveling on weekdays use a private car (3.15 million out of 15.62 million). Another 6.9% use taxis (1.07 million). Yet cars are the main cause of road congestion. According to Sedema, 83% of the 2.3 million vehicles in the ZMVM are private cars. The TomTom Traffic Index shows that in 2019 (pre-pandemic), Mexico City was the 13th most congested in the world. Average traffic speeds were 13.9 kph (slower than a bicycle) during peak times, according to the INRIX Global Traffic Scorecard 2019.

Additionally, vehicular traffic ("mobile sources") generates a significant percentage of air pollution in Mexico City, especially particulate matter, carbon monoxide, and nitrogen dioxide.

EMISSION TYPE	PM10	PM2.5	SO2	CO	NO2	COT	COV	NH3
MOBILE SOURCES	52.5%	55.7%	28.1%	86.4%	86.1%	16.1%	17.2%	6.4%

Source: Sedema 2016

To promote active mobility, reduce polluting emissions, cut traffic accident fatalities, and reduce congestion, a traffic management scheme for Mexico City is proposed. The scheme includes:

- a low-emission zone (LEZ)
- congestion charging
- remote parking (park and ride)
- superblocks (providing exclusive roads for pedestrians and micromobility)

Combined, the LEZ and congestion charging would:

- reduce the total number of vehicles in the zone, cutting congestion
- free up road space for providing safer pedestrian infrastructure, and cycle and bus lanes
- promote the use of lower-emission vehicles, increasing the use of micromobility, public transport, and electric or hybrid vehicles

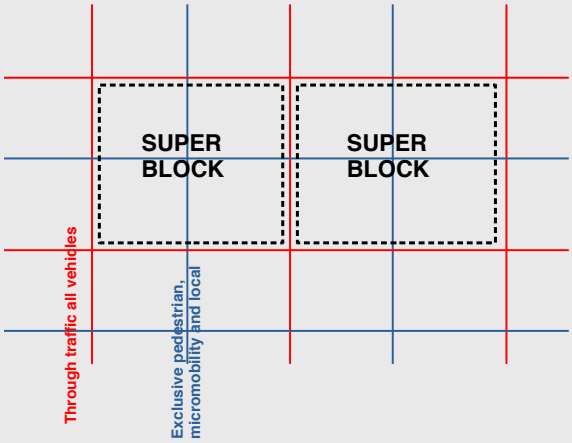
The congestion charge rate would vary depending on the type of vehicle and its impact in terms of emissions, congestion (space consumption), and road safety (weight, power, and operating speed).

Superblocks could roughly define two roads systems:

- one that continues to allow the circulation of through traffic, including private motorized vehicles
- another that provides connectivity exclusively for pedestrians and non-motorized or light vehicles

This would generate a far-reaching and exclusive network for pedestrians, non-motorized vehicles, and light vehicles without emissions.

Figure 1: Superblocks and road types



The Mexico City proposal would encompass the entire area within the interior ring road. This covers 94 km^2 and an estimated population of more than 1.5 million people (according to the SEDAC Population Estimation Service).

Figure 2: 15 districts within Mexico City's inner ring road

The 2017 Origin-Destination survey shows that within the metropolitan area, there are 34 million trips on a weekday (including some only walking), of which 5.9 million are in private cars. Of these car trips, nearly 1.7 million have either their origin or destination inside this area (28.5% of all car trips). This doesn't include purely internal trips (starting and stopping within the area) or through traffic. Based on these numbers, the potential impact of introducing the proposed traffic management scheme is huge. The scheme will also help towards achieving at least six of the Sustainable Development Goals:

- SDG 3 (Good health and well-being)
- SDG 9 (Industry, innovation and infrastructure)
- SDG 10 (Reduced inequalities)
- SDG 11 (Sustainable cities and communities)
- SDG 12 (Responsible consumption and production)
- SDG 13 (Climate action)

A new approach to waste

We must urgently find ways to turn burgeoning waste from cities into a resource

By Stella Kasiva, Assistant Lecturer, Jomo Kenyatta University of Agriculture and Technology, Kenya; and James Mwololo, Scientist, International Crops Research Institute for the Semi-Arid Tropics, Malawi

The world's urban population will double by 2050, estimates predict. This presents a number of sustainability challenges, like how to provide essential services such as housing, food, health, and education, as well as decent jobs.

Rapid urban population growth will affect the Earth's natural environmental systems, and will exert pressure on food production and use of energy, water, and land. There will also be a likely upsurge in the production of solid waste. Urban environments are associated with both organic and inorganic solid waste, such as construction debris, uncollected waste paper, food remains, plastics, metal scraps, and disposable medical remains. The associated environmental degradation caused by waste can in turn adversely impact the quality of health and services provided to urban populations.

Faced with rapid urban population growth, efficient approaches to waste management will be critical for providing safe and clean urban environments, while protecting cities from the harm caused by poor handling of urban waste. Global best practice, as advocated by Sustainable Development Goals (SDGs) 11 and 12, is for sustainable waste management. This includes promoting the principles of "prevent, reduce, reuse and recycle," as well ensuring proper collection and discharge of solid waste in urban areas, and reducing global food waste by half by 2030. In accordance with international standards, SDGs 11 and 12 also commit to the proper handling and treatment of chemical and other hazardous waste through its whole life cycle. Waste services also feature in the New Urban Agenda, through which UN-Habitat Member States commit to transforming and realizing universal access to sustainable waste management systems, minimizing landfill, and converting waste into energy, paying special attention to coastal areas.

A circular approach to waste management

Rising urbanization coupled with shrinking natural resources has led to a shift in the public's view of waste. Waste is no longer seen as the predictable outcome of industrialized economies but rather as a valuable and reusable resource. This is evidenced by the demand to invest in the circular economy worldwide. The circular economy disrupts the traditional "take, make, consume, and dispose" pattern of growth, and enables the reuse of solid waste in the economic production process. It also promises to generate economic growth, net savings for industry, and environmental benefits by:

- creating new businesses and job opportunities
- reducing the cost of materials, supply and production
- minimizing environmental degradation

New development agendas, policies and investment strategies should therefore be geared towards promoting the circular economy. Indeed, the European Commission adopted the circular economy action plan in March 2020, paving the way for a cleaner and more competitive Europe.

The approaches to circular economy adoption presented by the Ellen MacArthur Foundation and the Government of China, built on comprehensive analyses, advocate for circularity in everything from materials production through to products and systems (thus more aligned to the value chain approach). Additionally, the collective action of different sectors has contributed to the development of various tools that can act as a framework for implementation. In particular, there are now circular economy strategies and implementation databases for each part of the value chain. Experts in different fields can offer support to customize these tools for specific contexts.

Circular controversy

The circular economy is not without its critics, however. One of the principles of the circular economy is that it decouples economic activity from the consumption of finite resources. Yet some critiques question the sustainability of several approaches related to the circular economy, such as industrial ecology, eco-efficiency and cleaner production. The charge is that these approaches only achieve relative decoupling (slowing resource use relative to economic growth) rather than completely severing the link.

Second, there is a lack of conceptual clarity and standard definitions. In some accounts, the circular economy is treated as a new, innovative, and transformative initiative. However, academic literature also reveals credible evidence that the concept has existed since the 18th century. Lastly, organizations are implementing the

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▲ Rubbish being dumped at a camp for internally displaced people on the outskirts of Garowe, Puntland, Somalia. Without sustainable management, waste poses a threat to the safety of urban settlements and to the integrity of the natural environment

circular economy despite there being no comprehensive analyses of different circular economy strategies. This has led to dysfunctional implementation, and the possibility of insufficient robust mitigation measures in place to deal with potential future risks. While progress has been made in some developed countries, the implementation of the circular economy in developing nations could yet face major setbacks due to capacity and technological challenges.

Waste management as an integral part of a circular economy

A multifaceted approach is thus needed to apply circular economy principles to waste management, combined with a clear framework and strategy on how to replicate the approach around the world, including in developing countries. This is due to the complexity and variation in different countries, and the fact that the circular economy is "top-down" and dependent on government initiatives. Another complicating factor is the informal waste collection and recycling sector (scavengers) that dominates in developing countries, but not in developed countries.

Within the circular economy initiative, the recovery and remanufacture part of the value chain has received most attention. Waste collection and disposal are intertwined, and comprise half of the implementation cases. This is due to the historical development of circular economy elements within the waste management sector. As such, waste avoidance principles and tools have widely been formulated and included as elements of the circular economy, particularly in developed countries. Such development is a basis for replicating the same in developing countries. This in turn calls for Global North and South collaboration in the implementation of the circular economy initiative.

Indeed, managing waste better is considered by some to be the main reason to switch to a circular economy. Waste management stems from the recognition of the Earth's limited capacity for assimilating pollution, and is common to concepts such as "planetary boundaries." One obvious way that waste management integrates with circular economy principles is through the "four Rs": reduce, reuse, recycle and recover.

Conclusion

Despite the importance of the circular economy in waste management, there is no common ground between the various established approaches. Integrating circular economy principles within sustainable supply chain management must offer clear advantages from an environmental point of view. We need a new approach to ensure that sustainable waste management is cost-effective, creates wealth, is environmentally friendly, and protects public health. ■

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Reimagining cities

For the world's growing urban populations, the "new normal" must mean better and sustainable places to live and work, and ways to travel, for all – not just a privileged few

By Barbara Norman, Chair and Professor, Urban and Regional Planning, University of Canberra; and Peter Newman, Professor of Sustainability, Curtin University, Perth

Reimagining our cities has been reignited with the impact of COVID-19 on urban communities throughout the world. No longer can we rely on and assume historical patterns of journeys to work, full-time office employees and empty suburbs during the working day. With these changes during 2020 and 2021 come new opportunities and, with some creative planning and investment, the possibility of even more sustainable cities.

Throughout history, cities have moved in and out in size depending on the economy and the availability of new transport technologies. In recent decades cities were coming back in after 50 years of suburban sprawl. So will COVID-19 cause our cities to sprawl out again as people react against density rather than embrace it? Such sprawl has been associated with heavy resource use and multiple equity issues that would challenge many of the Sustainable Development Goals (SDGs).

American urbanist Richard Florida suggests that there will be an even

◂ A tunnel dedicated to bicycles in Seattle, USA. Many cities are striving to re-localize, to enable residents to reach all their essential destinations within 15 minutes of walking or cycling

stronger return to the city as "the clustering of ideas and talent is way more powerful a force than any infectious disease." He predicts a "roaring 2020s" style urbanism. However, the COVID reactions have set in motion a range of processes that could enhance the scattering of cities even further than we've ever imagined.

Digital meetings have become a much more feasible and productive way of doing face-to-face economic activity. Now, the acceleration of rooftop solar (currently the cheapest source of power in history) and electromobility (about to become the cheapest way to move around) make it possible for extremely cheap automobile-based transport to enable urban scatter. This would be driven by the wealthy seeking eco-security in gated communities, with all the best urban services.

As in all new eras of technological change, other options that can achieve better outcomes for the common good are feasible, and indeed make the SDGs even more likely to be achieved. Not only did we discover that we could work a lot more from home, we also rediscovered the importance of local places, services, parks, and community.

This shift towards re-localizing cities during the pandemic has led many cities like Paris and London to direct infrastructure spending into what they call the "15-minute city" (where everything a resident needs can be reached within 15 minutes by walking or cycling). Similar movements are underway in Sydney and Melbourne (the 20-minute city), and even in Stockholm (the 1-minute city). Transforming neighborhood centers supported by active travel has been the hallmark of COVID and can be built on.

All these initiatives are enabling the new electric bikes, scooters, and walking to be prioritized. These local areas that are rediscovering their place can also rebuild housing into denser precincts that enable greater community, while using the new technologies to share solar and electric vehicles of all kinds.

But cities and their regions also need transport links across their geographies, for various reasons. They may not need their historic centers quite as much, but they still need people to be able to move around. Electric public transport charged by solar at depots and station precincts can now compete with congested highways and enable cities to rebuild new localized centers, like pearls along their strings.

Many cities such as Canberra, Australia's capital, are seeing that they can now invest sensibly in zero-carbon electric transit and connect this to their local active travel through local centers. President Biden's Build Back Better plan has both these elements. Cities can use the plan to make more "inclusive, resilient, sustainable, and safe" settlements, as SDG 11 requires.

Lasting change?

So, the big question post-COVID and vaccinations is: will there be lasting change that scatters our cities into more wealthy and poor enclaves? Or will we be able to choose more "common good" outcomes that enable our cities to become better places for everyone, as well as for the planet? If so, what do we do with empty offices in town centers and increased congestion as people leave fixed transit? Can cities be rebuilt with new urban solutions? And will the nature of our suburbs need to change to meet new demands from home-based work?

The impact of COVID on the functioning of cities has been substantial in both developed and developing countries. But the issues of wealthy and poor enclaves, overly congested roads, and the need to leapfrog into new zero-carbon technologies remain high for all cities in both the Global North and South.

Bouncing forward by building back better, after such a shock to the urban system, provides the opportunity to implement the SDGs with multiple benefits to both people and the environment (see Future of Cities Will Shape Post-COVID-19 World and Apocalypse now: Australian bushfires and the future of urban settlements).

Villages within cities, with smart hubs meeting new community demands. Sustainable regional development capitalizing on more flexible work options and possible outmigration from global cities. Smart infrastructure and innovation investment providing connectivity and economic stimulus. All of these provide government and urban leaders with a unique opportunity to reimagine our cities to be more productive, climate-resilient and liveable in the future. ■

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Long-term focus?

Six years after signing up to sustainable development and climate action, are countries' plans fit for purpose to make long-term change?

By Guillaume Lafortune, Director, SDSN Paris; and Finn Woelm, Data Scientist and Analyst, SDSN

In 2015, UN Member States adopted the Sustainable Development Goals (SDGs) and the Paris Agreement on climate change, with objectives to be achieved by 2030 and 2050 respectively.

The COVID-19 pandemic is a clear setback. But governments all over the world should not lose sight of the long-term objectives they signed up to in 2015. First, because achieving the SDGs and the Paris goals will help prevent and respond to those low-probability, high-cost events such as pandemics that will inevitably strike again. And, second, because there is nothing in terms of technology or finance that says that goals cannot be achieved.

The SDGs and the Paris Agreement provide the vision for "building forward better." Yet, despite some progress on the SDGs since 2015 and increased country commitments to achieve climate neutrality by mid-century, governments' actions and investments so far have not been transformative enough to achieve internationally agreed targets for sustainable development. This is particularly true in G20 countries, responsible for 75% of global greenhouse gas emissions.

Yet achieving the SDGs and the Paris goals requires accelerated actions and leadership from G20 countries, especially on the energy and climate transition. This in turn needs a stronger focus on benchmarking: not only comparing outcomes and commitments but also aligning government actions, such as investments, subsidies, and regulations, to achieving the goals.

◂ NOOR II and NOOR III Concentrated Solar Power (CSP) project in Ouarzazate, Morocco. According to Climate Action Tracker, Morocco is one of only two countries that have plans compliant with the Paris Agreement's 1.5ºC target. The other is The Gambia

The pandemic has stalled progress on the SDGs

Before the pandemic hit, the world was making headway on sustainability and climate action. But the pace was insufficient in all countries, and no UN member state was on track to achieve all the SDGs.

Every year, SDSN and the Bertelsmann Stiftung publish the SDG Index and Dashboards. These track the performance and progress of all UN Member States on the 17 SDGs. The global SDG Index is based on 85 outcome indicators such as prevalence of extreme poverty, life expectancy, literacy rate, CO_2 emissions, and homicide rate.

The 2020 edition underlined that before the pandemic hit, on average, every UN region and country income group was making progress towards the SDGs. To a large extent this was driven by gains on socio-economic goals, including SDGs 1 to 9 that cover access to basic services and infrastructure.

Yet, the pace was not fast enough to achieve the SDGs by 2030. Some goals, especially SDGs 12 to 15 on climate and biodiversity, SDG 2 on sustainable agriculture and diets, and SDG 10 on reduced inequalities, did not show significant progress in many parts of the world, including in highly populated countries such as the G20.

Frustratingly, the COVID-19 pandemic has led to reversals in progress on many key SDG indicators.

The gap between long-term commitments and transformative actions

Due to time lags and data gaps in international statistics, it is important to also assess government commitments and pledges as well as their actions to gauge whether countries think and act for the long term. At the international level, outcome statistics are often three years old or more by the time they are published.

Also, looking at past growth rates to estimate future trajectories may not reflect accurately the introduction of transformative policies and actions. Benchmarking commitments and observable actions provides more forward-looking approaches to estimating countries' level of ambition for achieving long-term goals.

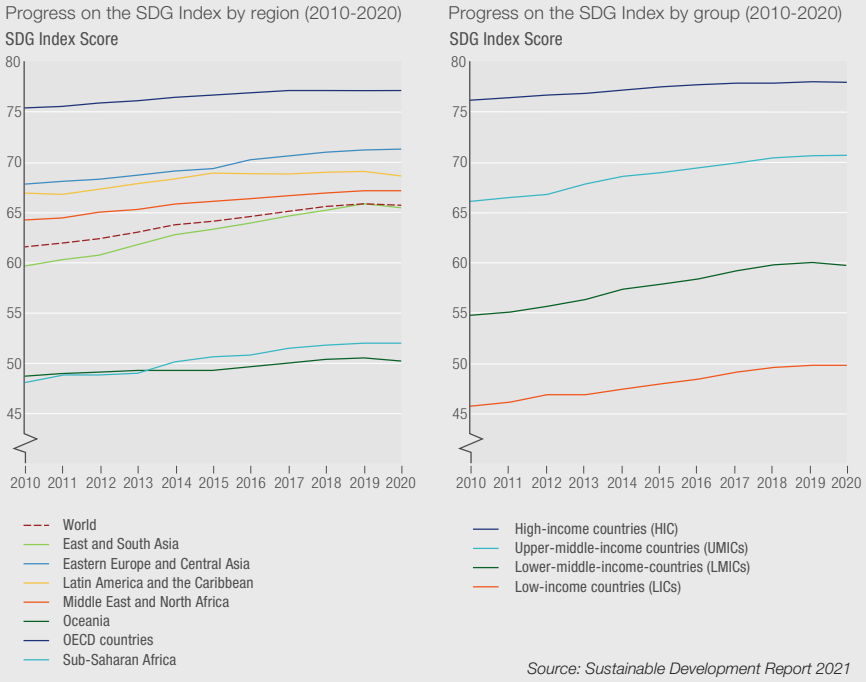
Estimating government commitments and actions for the SDGs and the Paris goals remains a difficult exercise. It relies on qualitative data (laws, regulations, policies, and so on) that are not standardized internationally, and on expert judgment. Yet, available data suggest that commitments and actions for the SDGs in G20 countries are largely insufficient, including on energy decarbonization, sustainable industry, and the objectives of the Paris Agreement.

Table 1 (overleaf) shows that G20 countries are responsible for the bulk of CO_2 emissions in both absolute and per capita terms. Besides Brazil and India, no G20 country is close to achieving the target of two metric tons of CO_2 emissions per person per year that is needed to limit global temperature rise to 1.5°C by 2050. The observed decline in in CO_2 emissions observed in some G20 countries since 2015 remains largely insufficient. Through consumption, many G20 countries also generate CO_2 emissions abroad (so-called "spillovers"). These include outsourcing the production of cement or steel, equivalent to three metric tons per person per year or more in Australia and the UK.

As of this writing in April 2021, six of the G20 countries have made no significant commitment to achieving climate neutrality by mid-century. Under the leadership of the governments of Chile and the UK, and with the support from UN Climate Change and the UN Development Programme, 121 countries (as of March 2021) have joined the Climate Ambition Alliance.

The alliance aims to "push for net-zero CO_2 emissions in line with latest

FIGURE 1: Progress on the SDG Index from 2010 to 2020



Source: Sustainable Development Report 2021

scientific information." According to the Net Zero Tracker, 32 countries have included a net-zero emissions target either in national law, proposed legislation, or a policy document. At the Leaders' Summit on Climate convened in April 2021 by the US administration, President Biden urged world leaders to accelerate efforts on climate actions.

In 2019 the European Union adopted its climate neutrality target (by 2050) via the European Green Deal. In 2020, several G20 countries, including Canada, Japan, South Korea, the US (all by 2050), and China (by 2060) committed to net-zero emissions. Meanwhile, Australia, India, Indonesia, Russia, Saudi Arabia, and Turkey are neither signatories to the Climate Ambition Alliance nor have committed in national policy documents to achieving climate neutrality by mid-century.

Despite these commitments and pledges for climate neutrality, government actions remain largely insufficient. The Climate Action Tracker (CAT) is a scientific evaluation tool developed by a research consortium specialized in the field of climate mitigation. It evaluates both the content of nationally determined contributions (what governments propose to do) and current policies (what governments are actually doing) to meet the objectives of the Paris Agreement. The latest CAT assessment covers 32 countries, including all G20 countries, and the European Union. No G20 country is considered to have aligned its actions to achieving the 1.5°C objective of the Paris goals.

According to Energy Policy Tracker, G20 countries continue to provide unconditional fossil fuel subsidies in COVID-19 recovery packages. In eight of the G20 countries, these subsidies exceed USD 50 per person of the population. Vivid Economics and Oxford University's Global Recovery Observatory also emphasize the lack of "greenness" in most G20 countries' recovery packages.

Four public governance priorities for achieving long-term goals

Looking ahead, we identify four public governance priorities for accelerated actions in both G20 and other nations.

First, countries need to emphasize long-term planning with support from science, engineering, and public policy. Countries should consider

TABLE 1: CO_2 emissions v climate pledges and actions in G20 countries

	OUTCOME INDICATORS (CO_2 EMISSIONS)			CLIMATE NEUTRALITY PLEDGES		CLIMATE ACTIONS	
Country/Region	**CO_2 emissions** (million tonnes, 2019)	**CO_2 emissions** (tonnes/capita, 2019)	**Imported CO_2 emissions** (tonnes/capita, 2015)	**UN Climate Ambition Alliance Signatory** (March 2021)	**Policy- or NDC-based commitment to reach net-zero emissions by 2050** (March 2021)	**1.5ºC Paris-agreement-compatible climate action** (Climate Action Tracker, 2020)	**Unconditional fossil fuel subsidies** (USD/capita, April 2021)
Argentina	178.9	4.0	0.7	✓	✓	Critically insufficient	30
Australia	411.0	16.3	3.0	✗	✗	Insufficient	34
Brazil	465.7	2.2	0.2	✗	2060	Insufficient	3
Canada	576.7	15.4	2.3	✓	✓	Insufficient	454
China	10,174.7	7.1	0.1	✗	2060	Highly insufficient	3
European Union	2,916.7	6.6	1.8	✓	✓	Insufficient	0
France	323.6	5.0	1.9	✓	✓	Insufficient	114
Germany	702.0	8.4	2.4	✓	✓	Highly insufficient	196
India	2,615.8	1.9	0.1	✗	✗	2ºC compatible	16
Indonesia	617.5	2.3	0.2	✗	✗	Highly insufficient	24
Italy	337.1	5.6	1.3	✓	✓	Insufficient	64
Japan	1,106.7	8.7	1.8	✓	✓	Highly insufficient	13
Korea, Rep	611.3	11.9	1.7	✗	✓	Highly insufficient	98
Mexico	438.5	3.4	0.4	✓	✗	Insufficient	24
Russian Federation	1,678.4	11.5	0.5	✗	✗	Critically insufficient	35
Saudi Arabia	582.1	17.0	1.5	✗	✗	Critically insufficient	7
South Africa	478.6	8.2	0.5	✗	✓	Highly insufficient	11
Turkey	405.1	4.9	0.5	✗	✗	Critically insufficient	167
United Kingdom	369.9	5.5	3.2	✓	✓	Insufficient	590
United States	5,284.7	16.1	1.9	✗	✓	Critically insufficient	219
Low-income countries*	185.7	0.3	< 0.1				

* Population-weighted average

Legend							
	< 200	< 2	< 1	Yes	Yes, by 2050 (or earlier)	1.5ºC compatible	0
	200 < x < 1,000	2 < x < 8	1< x < 2	(not applicable)	Yes, by 2060	2ºC compatible	0 < x < 50
	1,000<	8 <	2 <	No	No	Insufficient	50 <

Source: Sustainable Development Report 2021

medium-term targets with time horizons of 10 to 30 years (that is, 2030 for the SDGs and 2050 for the Paris Agreement) and develop policy pathways for achieving them.

In the context of the SDGs, the SDSN has proposed six SDG transformations that consider synergies and trade-offs across the SDGs and the institutional set-up within governments. Long-term pathways and backcasting exercises (working backwards from a desired future outcome to define the path to achieve it) can be done focusing on these transformations (or adjusted versions of them, depending on countries and context).

Second, budgetary frameworks and financing must be aligned with these long-term pathways to strengthen public investment in the SDGs alongside private financing. According to various estimates, the "greenness" of stimulus packages varies extensively from country to country, both in size and level of ambition. Private financing should also be further mobilized for the SDGs. The new EU taxonomy regulation for sustainable development that came into force in July 2020 is a promising effort towards redirecting capital flows into sustainable projects.

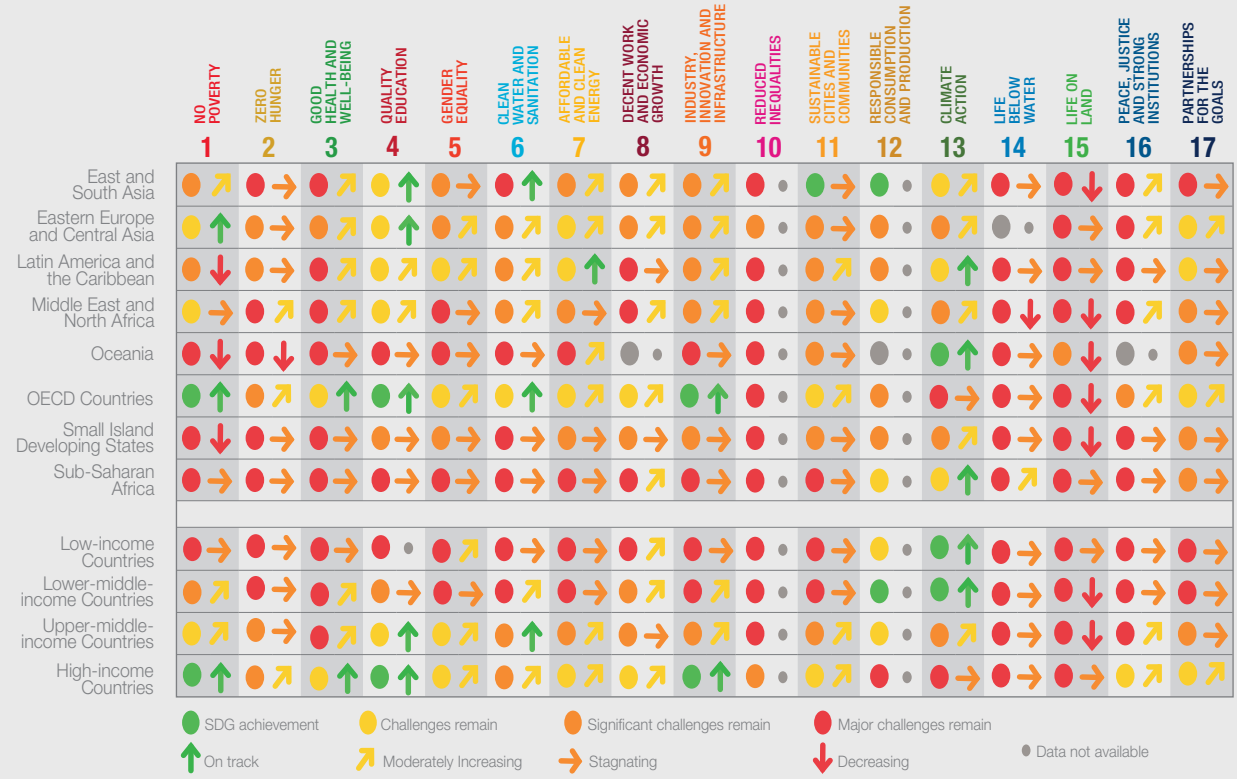
Third, SDG transformations can only succeed if they enjoy societal legitimacy. Political processes should engage the public in participatory decision-making and promote transparency and accountability. Recent engagement processes launched in France and the UK (among others) are moving in the right direction.

Fourth, global challenges and risks require global cooperation and responses. The COVID-19 pandemic and emergence of new variants highlighted that no one is safe until everyone is safe, calling for international collaboration to accelerate mass vaccination for all.

In a globalized and interconnected world, pandemics, climate change, cybersecurity threats, and other economic and social shocks cannot be managed by countries working independently. As the world recovers from the COVID-19 pandemic, strengthening multilateralism and UN institutions, including early-warning and monitoring systems, are key priorities for accelerated actions on the SDGs and the Paris Agreement. ■

FIGURE 2: 2021 SDG dashboards (levels and trends) by region and income group

The prevalence of red and orange dots, particularly when they form lines to indicate lack of progress on an SDG or in a regional group, demonstrate the scale of what needs to be achieved in the current decade



Note: Excluding OECD specific indicators. Population-weighted averages.

Source: Sustainable Development Report 2021

Fair finance

Development in low-income countries is too often thwarted by lack of access to finance. The Decade of Action demands that we connect promising projects in these nations with the capital lifeline they need and deserve

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By Preeti Sinha, Executive Secretary, UN Capital Development Fund (UNCDF)

One of the more disturbing impacts of COVID-19, amid the harrowing human tragedies, is the depth of economic damage the pandemic has wrought. Look no further than the top-line points from the United Nations' Financing for Sustainable Development Report 2021. A few examples:

- Global gross domestic product contracted by 4.3% in 2020, marking the sharpest decline in output since the Great Depression.
- Global output is expected to remain well below pre-pandemic trends.
- Disturbingly and unsurprisingly, losses in output and per capita income have reversed many years of income gains in developing countries.

Of course, the harshest of these impacts were experienced by the world's 46 least developed countries (LDCs). It proves, if proof were needed, that years of gains in Sustainable Development Goal (SDG) achievement can be eviscerated in a fraction of the time.

2020 was a reminder that unlocking the finance that will support both a resilient post-COVID economic recovery and accelerate SDG achievement in the world's developing and LDC markets (or, as I see them, pre-frontier markets) represents neither a development nor a finance challenge. Rather, it is a development finance challenge.

◂ A greenhouse project in the Herat district of Afghanistan, which is helping to diversify livelihoods and improve women's economic freedom. Only 6% of private finance mobilized by blended finance interventions go to LDCs, largely due to a lack of awareness of the opportunities. Agribusiness is one of several critical sectors that offers a wealth of investment potential

It is a challenge that calls for innovation and intentionality to unlock public and private finance to historically underserved markets to finance SDG-positive and transformative projects. And it is a challenge that calls for robust and experienced intervention to advance the structural improvements in these markets that will sustain SDG gains and support economic resilience. Addressing this hybrid challenge is central to UNCDF's mission and mandate as the UN flagship agency for LDC finance.

Scaling up inclusive digital economies and local development finance

Currently, only 6% of private finance mobilized by blended finance interventions go to LDCs, according to our flagship report Blended Finance in the LDCs. Even seasoned investors assume that low levels of finance flow to LDCs because of lack of a pipeline or projects with both commercial and development potential. The reality is that there is a wealth of projects in critical sectors: from energy to agribusiness, from healthcare to transportation to digital.

More likely than not, the challenge is that finance capital (whether commercial or concessional) is not connecting with these projects. Scaling up public finance mechanisms and markets on the ground is essential to providing the initial foundation for finance to flow to such projects. Meanwhile, we must ensure that economies are poised to be inclusive, dynamic, and sustainable in the future.

One area of involvement is cities and local governments. From plastic waste to peaceful streets to economic and social empowerment, cities and local governments are typically the leading providers of essential services. Yet the global financial ecosystem favors countries that have access to capital markets with sovereign guarantees and a monopoly of taxation. It's also biased towards large businesses, which can move capital with ease. Through our Local Development Finance practice, we work to scale up the transformative potential of local finance by increasing the flows of public and private capital in a variety of ways. These include:

- supporting policy and regulatory reforms for local governments
- strengthening domestic capital markets and local fiscal space
- financing development projects on the ground that possess both commercial and development potential (the role of our Dual Key pipeline management program)

This collective of capabilities enabled UNCDF in 2020 to support 536 local governments in 42 countries. Our support enhanced their subnational financial systems, creating fiscal space so that local economies can support future finance flows.

Another area is digital finance. Inclusion in the digital era is not a given. Technology itself is neutral, and can lead to either inclusion or exclusion based on how it is deployed and whether it is accompanied by measures prohibiting new forms of exclusion.

Although digital technologies can leapfrog traditional models of market expansion, adoption often depends on whether the intended clients understand, accept, and perceive real value added from those financial and non-financial digital services.

UNCDF's Inclusive Digital Economies practice deploys a market development approach to support digital economies by focusing on both the supply side (the "digital rails" or infrastructure) and the demand side (such as digital literacy-building and agent networks).

We focus on accelerating such market development at the country level with government, the private sector, and academia. We give specific attention to developing the right services to reduce the "digital divide" and to empower key customer segments, notably women, youth, and micro, small, and medium-sized enterprises (MSMEs).

Scaling up project preparation

UNCDF's work to scale up local transformative finance and inclusive digital economies has provided the platform to finance and support innovative projects with transformational potential.

To date, UNCDF has completed 674 localized strategic investments. These demonstrate the effectiveness of decentralized financing and contribute to COVID-19 emergency response and recovery efforts at the local level. We've also partnered with over 420 financial and digital service providers, small and medium enterprises, and public organizations to provide inclusive financial and digital solutions to over two million people in 44 countries.

In many other markets, such projects would have ready access to the financing, technical assistance, and business advisory services that would make them attractive to larger commercial lenders. Of course, this is hardly a given in pre-frontier markets.

With the right blend of finance through loans and guarantees, plus technical assistance and business advisory services, many of these projects can develop the capability to acquire commercial capital and achieve scale. UNCDF utilizes its pipeline of projects from our Local Development Finance and Inclusive Digital Economies practices. We provide the technical assistance and business advisory services that enable projects to attract follow-on, commercial capital while also advancing SDG achievement.

These projects occupy the pipeline for UNCDF's project preparation capability, conducted through our Least Developed Country Investment Platform. The platform is our on-balance sheet investment portfolio. It enables UNCDF to provide loans and guarantees that can position small businesses with commercial and development potential. It also allows us to execute our risk management and investment policies:

- due diligence processes for vetting and assessing risks of potential investment opportunities
- investment monitoring systems
- capacities to manage and oversee a portfolio of capital investments and ensure robust accountability

Since 2017, UNCDF has disbursed a total of 18 loans and three guarantees (in financial inclusion, food security, and green energy) in seven countries. The portfolio has increased by 45% compared with 2019. Just as importantly, our portfolio also proves that investments in these pre-frontier markets can indeed be commercially viable.

Scaling up finance

Scaling up finance in support of developing and LDC markets requires the same approach as any successful investment strategy: diversification. Investment projects in these markets are not monolithic: they feature different types and levels of capital, and different levels of transformative potential. That is why UNCDF, as the UN flagship agency for LDC finance, will look to scale up finance in three distinct ways.

For MSMEs in "last mile" markets (the businesses at the center of our traditional mandate), their capital needs typically lie between USD 50,000 and USD 5 million. This tends to be too large for microfinance, too small for institutional investors, and too risky for domestic banks. These projects require grants, technical assistance, and guarantees, which can fill capital needs while catalyzing follow-on finance into otherwise overlooked projects. This is just the sort of project finance we perform through our Local Development Finance and Inclusive Digital Economies practices.

For MSMEs with capital needs of USD 5 million to USD 25 million, blended finance solutions become a dominant source of capital. Blended finance vehicles can leverage official development assistance and other forms of concessional finance to absorb first losses on such projects, which can catalyze significant levels of commercial capital into otherwise overlooked projects. UNCDF is working with partners to capitalize and utilize two impactful blended finance vehicles:

- the BUILD Fund, a blended finance fund managed by Bamboo Capital Partners and targeting USD 250 million, which focuses on SMEs
- the International Municipal Investment Fund (IMIF), managed by Meridiam and targeting €350 million, which focuses on SDG-positive infrastructure at the local level

Finally, there are larger transformational projects, with financing valued at USD 20 million and above. Here, success requires convening big-ticket investment players, such as multilateral development banks, development finance institutions, and private capital investors.

Looking to the future, UNCDF wants to take advantage of its on-the-ground presence to provide a pipeline to ensure that projects in LDCs and other markets can access the levels of capital that can unlock transformational potential. Specifically, we will look to convene and syndicate with the relevant development and finance actors, such as those bigger players mentioned above.

A transformational journey

Transformation occurs when local governments and cities are given critical fiscal space, and where markets for digital economies are developed. Transformation also occurs when project preparation and finance are scaled so as to connect promising projects with a capital lifeline. Transformation, in other words, is not just the goal or endpoint of the journey. It is the journey.

UNCDF hopes to provide a model that can be deployed by all relevant actors in the development space, the finance space, or both. Our ambition is for these actors to finally and fully harness the hybrid power of capital: to deliver return on investment and to leave no one behind. ■

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Bridging the growing finance gap

If generating the finance to achieve the SDGs seemed a tall order pre-pandemic, it looks much harder now. We must rapidly accelerate the take-up of financial instruments for sustainable development, and attract a wider range of investors, if we're to meet the 2030 deadline

By Felipe Larraín Bascuñán, Professor of Economics, Universidad Católica de Chile; former Finance Minister of Chile; and Luis E. Gonzales-Carrasco, Environment and Energy Economist and Coordinator, Clapes UC, Chile

The COVID-19 pandemic and environmental deterioration (reflected in climate change, water scarcity, and the extinction of countless species) are exacerbating structural problems such as poverty in developed and developing economies alike. One way to face these challenges is by improving the coordination of finance to achieve the Sustainable Development Goals (SDGs). This article addresses two important dimensions. First, the challenge of mobilizing resources from the public and private sectors to face a post-COVID-19 world. And, second, the general conditions for issuers and investors to be able to connect the demand and supply of resources for the SDGs with acceptable levels of risk.

COVID-19 has caused the most severe economic, social, and human crisis since the second world war. To date more than 130 million people have been infected and about 3 million people have died. The crisis has further exacerbated the needs that were dire even prior to the pandemic, one of which is how to finance the 17 SDGs.

▲ Cape Town, Strandfontein waste-water treatment, which also provides one of the most important habitats for wetland birds in South Africa. Cape Town has been suffering a water crisis since 2015. The city is financing the upgrade of its essential water systems though a green bond accredited by the Climate Bonds Initiative

SDG financing and the pandemic

Before the COVID-19 pandemic, achieving the SDGs by 2030 required bridging a finance gap of an estimated USD 2.5 trillion a year. In 2020 alone, USD 1 trillion in external financing was earmarked for emerging and low-income economies to soften the economic effects of the pandemic.

FIGURE 1: SDG financing needs and public stimulus packages in developing countries

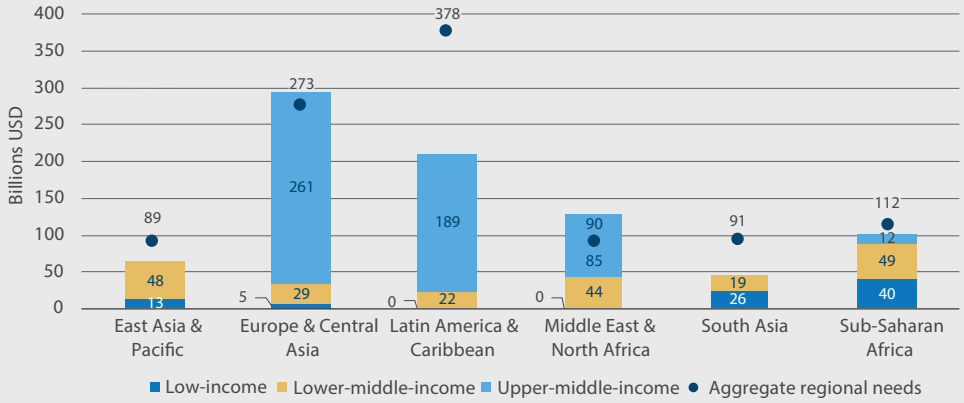
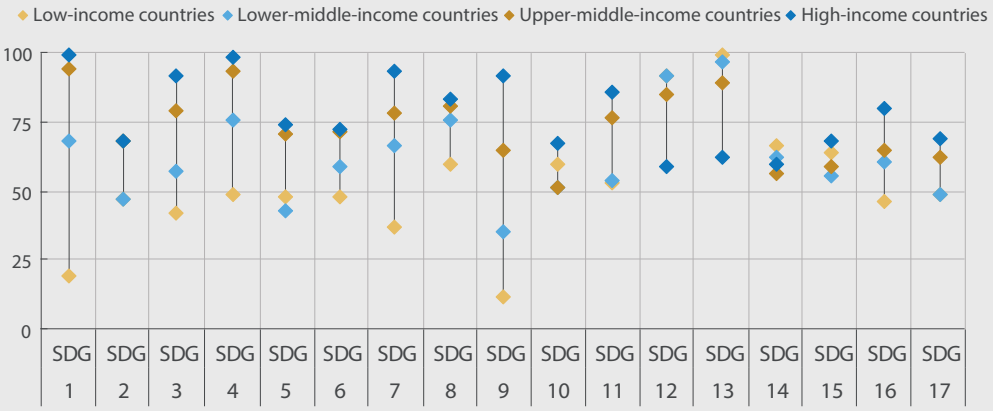


FIGURE 2: The SDGs in 2020



Source: OECD, Global Outlook on Financing for Sustainable Development 2021

Currently, it is estimated that returning to the previous path to reach the SDGs by 2030, some USD 4.5 trillion will be needed annually. This requires a major effort in resource mobilization.

To measure the economic, social, and environmental effects of the pandemic, note that in just a few months, progress in the fight against poverty fell back by at least two years, exposing some 100 million people to the brink of extreme poverty. The fall in economic activity has meant a loss of close to 3.5% in global output with the consequent destruction of more than 200 million jobs.

Meanwhile, figures from the International Energy Agency show that after a steep drop in CO_2e emissions in early 2020 (meaning overall emissions for the year as a whole fell 6%), emissions had rebounded by December, up 2% compared with the year before.

The financial situation countries face, whether looking at their own budgets or factoring in external resources, is challenging. Developed countries expect a total debt of 124% of GDP by 2021, similar to that registered after the second world war. Developing countries, meanwhile, are set to reach debt levels equivalent to 62.5% of GDP, the highest since records began. Figure 1 shows that the SDG financing needs in developing countries grouped by income level vary greatly between regions and levels of development.

Progress towards the SDGs

Another way of discussing the challenge of financing from private and public sources is by looking at the progress towards sustainable development across the Global Goals.

Between 2015 and 2019, the world made significant progress towards eliminating poverty (SDG 1). Extreme poverty, although not eradicated, was on a downward trend, reaching 8.2% in 2019 due to rapid economic growth, especially in East and South Asia. Progress in health outcomes (SDG 3) and educational attainment (SDG 4) was also notable, with heavy investment in schools, immunization campaigns, and maternal health, although progress toward other goals, such as achieving reading literacy, was slower. Investment in infrastructure also increased significantly. For example, electrification rates (SDG 7) increased globally from

83% to 90% between 2010 and 2019, and industrialization (SDG 9) increased slightly in less developed countries.

But progress towards other SDGs has stalled or reversed. Food insecurity (SDG 2) rose between 2015 and 2018. Inequalities (SDG 10) have increased in some regions, as affluent people have continued to see their wealth and income rise while protection of the most vulnerable has weakened. Progress for girls and women (SDG 5) has been uneven. The global material footprint (SDG 12) continues on an unsustainable path, while global greenhouse gas emissions increased between 2015 and 2019, with no signs of reduction.

Biodiversity has decreased. Fish populations have continued to decline (SDG 14) and species extinctions threaten sustainable development and compromise the world's global heritage. These extinctions are driven primarily by habitat loss from unsustainable agricultural practices, as well as trade, deforestation and invasive alien species (SDG 15). Furthermore, the proportion of the urban population living in slums is once again growing after years of decline. Access to water and sanitation is not improving due to rapid urbanization (SDG 11).

Green bonds and ESG criteria: lessons and challenges

Two approaches that governments, companies, and organisations can use to finance projects that seek to mitigate and adapt to climate change (and pursue social objectives) are green bonds (sovereign and corporate) and more generally the promotion of environmental, social, and governance (ESG) investment criteria.

Figure 3 shows the green and social financing (mainly bonds) in Latin America, one of the regions with the greatest dynamism in the sustainable and green bond market. As the figure shows, only a few countries have made extensive use of ESG financing, most notably Chile, Brazil, and Mexico.

The slow development of these financing sources in several countries may be partly caused by the lack of understanding about these instruments and the difficulties in the certification and identification of projects that are required.

For sovereign issuers, it is important to create an institutional base to establish the roles of national agencies in the measurement, reporting, and verification of projects. This would allow countries to determine the types of eligible public spending and the sectors that can be financed. Countries must also develop a comprehensive framework within the public sector to improve the processes of selecting and allocating resources transparently and efficiently.

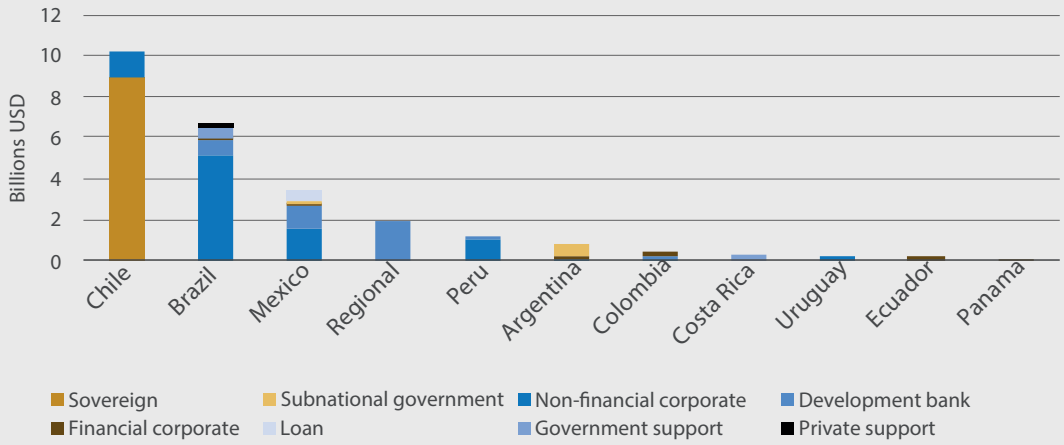
It's important to make potential investors aware of the financial benefits that these options represent. In the Chilean case, the green bond achieved a five basis points premium (lower yield) over comparable non-green sovereign securities. Issuers also need to reach out to the wide variety of potential, perhaps non-traditional, investors who may be attracted by these specific types of instruments.

One other aspect to consider is the heterogeneity in investment metrics, ratings and approaches that makes it difficult for regulators, investors and issuers to assess the performance of these instruments. Market participants often lack the tools they need, such as consistent data, comparable metrics, and transparent methodologies, to adequately inform decisions, manage risks, measure results, and align investments with long-term sustainable value. This is despite the proliferation of ratings, methodologies, and metrics. So there must be a general taxonomy to facilitate the participation of investors.

If these challenges are addressed, ESG instruments can be a powerful way to finance the SDGs as the world recovers from COVID-19. ■

References available at: https://sdg-action.org/coordinating-disparate-sources-of-finance-to-achieve-the-sdgs/

FIGURE 3: Sustainable and green financing by country



Source: Luis E. Gonzales

Who rests, rusts

Liechtenstein banks aspire to play a creative role in developing a more sustainable global economy and inclusive society. The theme of our Roadmap 2025 is growth through innovation and sustainability

Simon Tribelhorn,
CEO, Liechtenstein Bankers Association

Without the past, there is no future. Tradition is important – especially for banks like ours, given that they pursue a long-term, cross-generational approach in all their thought and action. But we cannot rest on the laurels of our past. In other words: tradition must not mean that we unconditionally stick to what we've always done, without constantly questioning ourselves and our surroundings. We need a good mix between the proven and the new – between tradition and innovation.

This is why, together with our member banks, we have developed our new multi-year strategy, Roadmap 2025. Its leitmotif is "Growth through innovation and sustainability," deliberately placing an even greater emphasis on sustainability than we already have in the past. The goal is for the banking center to play a crucial and creative role shaping the so urgently needed transformation of the global economy and society towards greater sustainability, and to achieve a real impact with our products and services for the benefit of our clients and future generations.

We strive for a comprehensive approach to sustainability, whereby the 17 Sustainable Development Goals not only serve as guiding principles, there is a strong business imperative to deliver them.

The 2017 Better Business, Better World report revealed that pursuing sustainable and inclusive business models could unlock economic opportunities worth at least USD 12 trillion a year by 2030 and generate up to 380 million jobs, mostly in developing countries. Hence, we do this knowing that our clients expect more than simply high-quality services.

Our clients also want financial institutions to contribute to solving the environmental and social challenges of our time. Are we on the right track? Yes, we think so, but we are aware that much remains to be done and we need to speed up all our efforts. And again speaking for Liechtenstein banks, especially in our core business – investment advice and asset management – our range of products and services must be swiftly further expanded.

The coronavirus pandemic has caused us all – including investors – to reflect more deeply about the future. The focus has shifted dramatically towards health and security, and sensitivity about one's own financial security in the future has noticeably increased. The slowing down of our

everyday lives has led to a speeding up of sustainable investments. A change in thinking can be seen in society, politics, and business.

Energy companies are looking for new, sustainable business models, and even traditional car producers are converting their entire fleet to e-mobility, to name just two examples.

In addition to sustainability, we must also incorporate the opportunities and risks of digitalization in a meaningful way. COVID-19 has shown us this impressively as well. In particular the way we work, and above all where we work, changed significantly during the coronavirus pandemic.

Up to 90% of the employees of our financial institutions had to work from home and in some cases still do. Coronavirus dramatically accelerated the already existing trend towards more compatibility of family and career of all our workforce. What was unthinkable just a few months ago has suddenly become reality and will certainly become an integral part of our everyday life in the future. In the medium to long term, hybrid forms of working, or the "flexible office," are likely to dominate after the pandemic.

Three key questions

In any event, three questions relating to this new world of work will occupy us in the banking sector for quite some time. Firstly, what impact will these developments have on corporate culture? Since management guru Peter Drucker, we know that culture eats strategy for breakfast. This spirit is strongly influenced by interaction among employees. Atmosphere, personal exchanges, and joint activities help shape identity. In the 'flexible office,' where everyone is hardly ever on site at the same time, these drivers are missing. As a consequence, culture must be rethought and put into practice differently.

Secondly, personalized services and support for our clients continue to be of vital importance, especially in the core business of our member banks, asset management.

Only the future will tell to what extent this will still go hand in hand with interactions in person and on site. Clearly, younger generations are more mobile, digitally savvy, and used to virtual interactions. At the same time, they expect more than merely customer care; they desire customer experiences.

For the service industry in general and banks in particular, the challenge will be to remain relevant to tomorrow's customers and to create traceable and measurable added value in a digital world.

And last but not least, the "war for talent" is likely to intensify. Qualified personnel will continue to be scarce, especially for a small country like Liechtenstein, which is dependent on workers from abroad. Companies will be challenged to offer employees tailored working models that are optimized to their work and objectives, and that both create attractive jobs and ensure business success.

Fit for the future

Having said that, building back better and playing an active role in this will demand a lot from banks and the financial industry, but it also brings enormous potential opportunities for those who are willing to assume their responsibility for a modern society, for the implementation of the SDGs and to net zero. Or as Woodrow Wilson rightly said: "Responsibility is proportionate to opportunity."

We still face the greatest challenge, namely to make the technological change usable for our transformation into a more sustainable economy. Digitalization and sustainable development go hand in hand. However, time is running out and the house is burning. Quick action and leadership is needed to unlock the trillions necessary for a sustainable future.

In Roadmap 2025, we have addressed these and other questions relating to a new economic and working environment, and defined concerns and measures to become fit for the future in this area as well. ■

About the Liechtenstein Bankers Association

Established in 1969, the Liechtenstein Bankers Association is the domestic and international voice of the banks operating in and out of Liechtenstein.

It is one of the country's most significant associations and plays a key role in the successful development of the financial center. Member interests are pursued in accordance with the principles of sustainability and credibility.

As a member of the European Banking Federation (EBF), the European Payments Council (EPC) and the European Parliamentary Financial Services Forum (EPFSF), the Liechtenstein Bankers Association is a member of key committees at the European level and plays an active role in the European legislation process.

Since 2017, the LBA has also been a member of the Public Affairs Council (PAC) with offices in Washington and Brussels, and since 2018 of the international network "Financial Centres for Sustainability" (FC4S).

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Reinventing capitalism

We need a new form of capitalism, one that values and rewards sustainable practices and gets us on the path to 1.5°C. Business leaders are rising to the challenge and rallying behind a bold agenda for business action and long-term value creation, fully aligned with the SDGs and the Paris Agreement

By Peter Bakker, President and CEO, World Business Council for Sustainable Development (WBCSD)

Our world is facing three pressing global challenges: climate emergency, loss of nature, and growing inequality. Each of them, on its own, can endanger the safe operating space for humanity and the planet, as well as the license to operate for business. And if there is one thing that we have learned from the COVID-19 pandemic, it is how interconnected these challenges are.

Action to address these challenges and for accelerating the transition to a sustainable world is urgently needed now. It's essential if we are to achieve the UN Sustainable Development Goals (SDGs) and the Paris Agreement's goal to limit global warming to well below 2°C, to 1.5°C above pre-industrial levels. We also need a long-term vision that we can all rally behind: over nine billion people living well, within planetary boundaries, by mid-century.

This is the vision of the comprehensive, forward-looking, and pragmatic Vision 2050: Time to Transform report. It has been developed over the past two years by more than 40 global business leaders united in the World Business Council for Sustainable Development (WBCSD) and a strong external review committee.

Achieving this relatively simply worded vision requires a wholesale transformation of everything we have grown up with. Energy must decarbonize, materials need to go circular, and food must be produced sustainably and equitably, providing healthy diets. The need to transform systems is rightfully the concept that everyone in sustainability is talking about, and it must be backed up by actions. It is now or never.

Hence, the Vision 2050 business framework focuses on nine pathways of systems transformation, written in an actionable format, and aligned with the SDGs and the Paris targets. Each of the nine transformation pathways

◂ Environmental protest outside the Shell building in The Hague, Netherlands as the company holds its annual shareholder meeting. Pressure from shareholder groups such as the Transition Pathway Initiative have elicited a commitment from the company to become a net-zero enterprise by 2050. A resolution at the latest AGM from the group Follow This to accelerate the process gained support from 30% of shareholders

contains 10 action areas for the decade ahead. These areas are designed to help companies drive transformative change in their strategies, business operations, and impact on society.

Reinventing capitalism: mainstreaming ESG

Making real progress on the nine pathways will depend on radical shifts across three strategic business mindsets. Leaders everywhere need to change their mindsets toward:

- building long-term resilience
- a regenerative approach to business
- ultimately, reinventing capitalism

The most critical of these mindset shifts is that of reinventing capitalism. It means that economic systems, incentives, global accounting standards, and capital market valuations will no longer just be based on the financial performance of business. Instead, they will integrate the impact on the planet and people as part of how we define success and determine the enterprise value.

Integrating environmental, social, and governance (ESG) into mainstream finance will be crucial. Transparency will help, giving way to capital markets that properly value and reward sustainable practices and mobilize more capital to ultimately accelerate sustainable development and the transition to a 1.5°C world. Doing so will go a long way to helping to build long-term resilience into the global economic system, and to supporting more robust decision-making and long-term value creation. All of these are critical elements of reinventing capitalism, so that it no longer encourages the kinds of behaviors that contribute to climate change, nature loss, and inequality.

Companies cannot reinvent capitalism on their own. But they can recognize that the system they are part of is failing society in significant ways, and can do something about it. A reinvented capitalism has five key characteristics that companies should strive for:

1. Stakeholder-oriented, rather than shareholder value maximising

The purpose of business is to create value for all stakeholders: employees, customers, suppliers, communities, the natural environment, and shareholders. These multiple obligations can and should be harmonized and incorporated into corporate decision-making, governance models, and incentive systems.

2. Impact-internalizing, rather than impact-externalizing

Positive and negative social and environmental impacts should be internalized into the relative price of goods and services, and market valuations of companies. Businesses and investors should seek to optimize performance across three dimensions: risk, return, and impact. Governments should step in to price externalities where markets are not able to internalize them on their own.

3. Geared toward the long term, rather than the short term

The goal of reform should be to stretch businesses' and investors' time horizons to better align these with the much longer timeframes over which social and environmental feedback loops play out. This would lead to better pricing and management of long-term risks such as climate change, ultimately averting "the tragedy of the horizon."

4. Regenerative, rather than degenerative

Regenerative capitalism is based on the premise that there are universal principles and patterns of systemic health, such as circularity and balance, that can and should be integrated into economic system design. Companies should seek to actively contribute to the health of economies, societies, and the environment. Both business and policy action should be guided by the need to preserve and enhance multiple forms of capital, including social and natural capital.

5. Accountable, rather than unaccountable

Both capital markets and regulators must provide active oversight and control of companies, holding them accountable for their actions and impact. Investors should prioritize stewardship, not just profit maximization. Fiduciary duties should evolve to reflect this dual purpose. It is also essential for markets to be regulated and counterbalanced by governmental and non-governmental institutions that are strong enough to be effective, and inclusive enough to represent the interests of society as a whole.

In closing: it is time to transform

There is an increasing awareness and recognition of the vital role that businesses and capital markets can have in realizing the ambitious targets set out in global agreements such as the SDGs and the Paris Agreement.

We need to fundamentally reinvent capitalism and redefine the meaning of value creation. We are at the start of the decade of delivery. Businesses and financial institutions who take into account a wider range of capital and develop innovative business models will be better equipped to adapt to emerging issues and remain competitive in a fast-changing world. The move to a capitalism of true value for all will accelerate, faster than anything else, the transformation toward nine billion+ people all living well, within planetary boundaries.

I see this as a hugely exciting prospect, but I know it's not an easy one. Whether you like it or not, we are all changemakers now. Business must play a leading role in transforming toward Vision 2050, working together with governments, regulators, investors, and all people. It is time to transform. It is time to think systems. It is time to create true value, now. I count on every changemaker (that is, everyone) to join us on the decisive journey of our generation. ■

Rooting out bad money

From illegal pollution to terrorism, one critical way to curb nefarious action is to identify and cut off its finance. How can we do this for abuses that threaten the SDGs?

By Olajumoke M. Akiode, Executive Director, Center for Ethics and Sustainable Development, Nigeria

The abuse of people, systems, institutions, and environment exists in all societies. But the type, scope, prevalence, impact, and established framework of enforceable deterrents differ in each region and nation in the world. In the same vein, there are enabling factors that incentivize every abuse, from rainforest destruction to toxic pollution, from terrorism to exploitation of labor.

One critical enabling factor is finance. How can we expose and remove the sources of finance that enable such abuses?

The UN 2030 Agenda for Sustainable Development provides a guiding framework for resolving these abuses and more, if implemented effectively. It states: "We are resolved to free the human race from the tyranny of poverty and want and to heal and secure our planet. We are determined to take the bold and transformative steps which are urgently needed to shift the world on to a sustainable and resilient path. As we embark on this collective journey, we pledge that no one will be left behind."

However, to activate the agenda of "exposing destructive enablers," we need to fully understand the enablers for what they are. This will allow us to identify, expose, and proffer actionable solutions using the approaches of systemic thinking and backcasting (working backwards from a desired future outcome to identify the policies and programs to achieve it).

Destructive enablers

Even when restricting our focus to the realm of finance, the problem of destructive enablers is a complex one to solve. We need to answer the "what," "why," and "where" posed by systemic thinking questions. For example, what are the circumstances, factors, conditions, values, and patterns that surround the problem? What are the boundaries that separate the problem from its environment? To find answers, we must critically examine some examples.

First, in Nigeria the crisis of deforestation and climate change is fueled in part by the highly lucrative hardwood charcoal business that serves both domestic consumption and massive overseas demand. Locally, charcoal is a cheap source of energy compared with alternative sources like kerosene and gas. Internationally, demand has been fuelled by the need for alternative energy sources with a low carbon footprint. Between 1990 and 2005, Nigeria lost 35% of its rainforest cover. The "destructive enabler" here, then, is patronage from local and overseas consumers.

A second example concerns Nigeria's free trade zones. For example, the Lagos State Government appears determined to attract foreign direct investment (FDI) at all costs, offering provisions or waivers that did not benefit from proper stakeholder consultation and social inclusion. Some of the provisions will violate human and labor rights and may stifle local industrial growth, and so are in direct contradiction with both the Sustainable Development Goals (SDGs) and the government's diversification and development drive.

Third is Nigeria's terrorism problem, spearheaded by Boko Haram, and involving alarming and incessant attacks on Nigerians. It appears that Boko Haram receives local funding. This is corroborated by the allegation made by Obadiah Malaifa, a former deputy governor of the Central Bank of Nigeria, that terrorism in Nigeria is funded by some northern elites, including some past and sitting northern governors.

Applying systemic thinking to these problems or crises helps to provide context. It exposes their underlying patterns and systemic structures. It then makes it possible to tease out their destructive enablers, to expose and remove their sources of finance. It also helps us to identify leverage points to support the desired, constructive change. While finance is clearly an important destructive enabler in these highlighted crises, other factors such as weak institutions (and their inability to enforce policies and penalties) and a lack of political will also play contributory roles.

We can then use backcasting to envision the achievement of the SDGs, where destructive enablers have been addressed, and work backwards to the present day to clearly outline what has to be done.

Collective action

Achieving the SDGs' broad vision requires collective action by all stakeholders at the local, international, and global levels. It also calls for

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▲ Logs awaiting processing in Lagos Lagoon near the informal settlement of Makoko Community. Between 1990 and 2005, Nigeria lost 35% of its rainforest cover

bold steps and initiatives by the collective bodies behind the 2030 Agenda. It is important to reflect on the interconnectivity of the SDGs, to realize that the crises highlighted above contribute to sustaining and reinforcing the problems the SDGs are designed to address, especially poverty and environmental protection.

In the case of Nigeria's charcoal industry and the attendant massive and ongoing deforestation, we need to rework the existing ineffective attempts to address the problem by Nigeria's National Environmental Standards and Regulations Enforcement Agency. NESREA's efforts to check illegal and unregulated tree felling and encroachment into forest reserves, as well as its licensing procedure to regulate stakeholders and boost exports, and even its temporary export ban, have all failed to yield the desired result.

Instead, Nigeria needs a coordinated, ICT-supported afforestation, reforestation, and rehabilitation program in collaboration with other international stakeholders. This would ensure, through digital documentation and tagging, that felled trees and the end products they produce have been replaced with new trees. It would also enable digital monitoring of compliance. Local traders, foreign buyers, and charcoal importers that fail to comply should face stiff penalties.

For the proposed free trade zones, to prevent the flow of destructive funds into the state, we must urgently review the provisions or waivers given to woo prospective FDI in the Lekki Free Trade Zone and similar Free Trade Zones in the country. Similarly, the source(s) of the funding for terrorism should be investigated and appropriate actions taken to stop the flow of such funds as well as stiff penalties for their sponsors.

There is a need for collective action both locally and internationally. The starting point should be a baseline study, providing policymakers and stakeholders with the data to inform evidence-based decisions. Active citizenship will also play a critical role. People's voices must be heard loud and clear to inform both proactive and reactive actions to address the problems.

Unfortunately, the civic space is shrinking daily in Nigeria. There are widespread clampdowns on citizen agitation both in public and behind the scenes. Such human rights violations demand international intervention and coordinated sanctions, in line with the UN's agenda to ensure sustained democracy. This is vital to ensure that destructive enablers in the form of finance, and systemic structures, are exposed and removed. By taking bold actions in line with the UN SDG agenda and truly walking the talk of the agenda, we can ensure transformational change. ■

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Global climate ambition

With a stronger concentration of national leaders who recognize the need to act, what can we now realistically hope to achieve on climate action?

By Teresa Ribera, Deputy Prime Minister for the Ecological Transition and the Demographic Challenge of the Government of Spain

The world has rarely, if ever, experienced such a turbulent time since the countdown began in December 2015 to reach a decarbonized future. The lost years of Trumpism, rampant climate denialism, and the insufficient ambition of some nations have slowed down the race to climate action that the Paris Agreement augured. COVID-19 has interrupted the climate challenge, necessitating immediate and effective responses to the devastating health, social, and economic impacts of the pandemic.

The urgency of the coronavirus response should not, however, displace the importance of tackling the climate problem. As aptly summed up in a recent Time magazine cover story, "climate is everything." If the pandemic has made one thing clear, it is the interconnectivity between the health of the planet and the health of its people.

Those of us who enthusiastically celebrated the historic pact reached five years ago at COP21, against the backdrop of the Sustainable Development Goals, are raising our voices again. Now more than ever we must increase our collective commitment and lead by example.

A world without carbon in 2050 is a world that's more sustainable and, therefore, safer. That is the objective we must pursue so that global average temperatures do not rise by more than 1.5°C and we therefore avoid the

◂ US President Joe Biden addresses world leaders during a virtual Leaders Summit on Climate. The event reflected a newfound sense of urgency, with President Biden pledging to halve US greenhouse gas emissions by 2030

most catastrophic effects of climate change. The effects are well known: more frequent and intense extreme meteorological events, more severe droughts, destruction of the coastline, increased climatic migration, new social tensions, and so on. But, above all, limiting temperature rise means avoiding the loss of the main natural barrier against viruses: our biodiversity.

Raising ambitions

The return of the United States, the largest historical emitter of greenhouse gases (GHGs), to the climate fight is undoubtedly a cause for hope. The fact that its new president, Joe Biden, has committed to the United Nations to reduce net GHG emissions by between 50% and 52% in 2030 compared with 2005 levels (doubling the objectives of the Obama era) inaugurates a new age. It puts the climate agenda and multilateralism back where it always should have been.

We must raise ambitions. It was the message most chanted by the 40 world leaders during the summit that the White House itself convened in April 2021, and which allowed the establishment of new contributions and renewed commitments. With our sights set on the Glasgow Climate Change Conference (COP26), all countries must increase their efforts to bring climate neutrality closer to grasp.

Europe has already done its homework in this regard, advancing its emissions-reporting target to 2030 and giving the green light to the European Climate Law. This is a milestone that reinforces the continent's climate leadership in regulatory matters. It facilitates decision-making on climate change, the scientific knowledge base, social justice and economic viability, all within environmental limits.

The NextGenerationEU recovery plan draws on that same conception of progress. It constitutes the preliminary construction of a new growth model that seeks to abandon failed prescriptions and embark on new paths to build prosperity and resilience. This is because climate action is a question not just of our planet's survival. Decarbonization is also a unique opportunity to cooperate, innovate, create quality industry and employment, and bring access to modern and affordable forms of energy.

Spanish lesson

Spain is no stranger to this challenge. Our country is the most biodiverse in Europe, but also one that will suffer most from the consequences of the climate crisis if GHG emissions are not urgently mitigated. According to some studies, our country has been warming around 0.1°C per decade since 1850, a rate slightly higher than that detected for all continents. This warming has accelerated since the 1960s, to 0.3°C per decade. Spanish summers have lengthened by five weeks compared with the 1980s.

Last winter, we witnessed this changing climate with the Filomena winter storm and the subsequent cold wave that caused a difference of 55°C between the coldest and hottest day in our territory. We need to adapt our cities, towns, infrastructures, and natural spaces to climate change. This must affect all areas of society: industry, health, mobility, agriculture, tourism, among others.

Not taking action would mean taking on more risks, more costs in lives, and increased economic damages. It would mean giving up changing an exhausted and unsustainable model and losing opportunities to create jobs, modernize our economy, and attract investment.

Even so, after years of delay in climate matters, we can say that Spain has taken a step forward. Our country finally has its own climate law, which lays the foundations to achieve emissions neutrality by mid-century, with targets that can only be revised upwards. The project is accompanied by measures that will facilitate a just transition for the most vulnerable groups and geographic areas, including rural areas.

The quantified targets we set for ourselves are above those set by the EU in its 2030 Climate Target Plan, in both the 40% and 55% emissions-reduction scenarios (compared with 1990 levels). Specifically, by 2030, Spain is committed to:

- a 39% reduction in emissions in diffuse sectors (mobility, thermal uses in buildings, waste, and agriculture)
- renewable penetration of 42% in final energy consumption and in 74% of the electricity market
- greater energy efficiency, leading to a reduction in primary energy consumption of at least 39.5%

This is an ambitious path that will require a huge effort, but it is compatible with full decarbonization. We are in a strong position to undertake this profound change.

We believe that our Climate Change and Energy Transition Law is only the first step in the transformation of our country. Its implementation is expected to generate between 250,000 and 350,000 jobs annually, attract more than €200 billion of investment, and boost Spanish gross domestic product by 1.8% over the next 10 years.

It is under this umbrella of action that we want to promote and declare a clear political signal of where Spain wants to position itself in the European and international arena. This is also demanded by its citizens: the Spanish population ranks as the most concerned about climate change of all EU countries, according to Eurobarometer.

Climate is everything. And affects everybody. Activating a transformative, ambitious and inclusive response to this global emergency is a collective task. How humans produce, move, eat and consume will define the risks we must face in the coming decades.

With time against us, postponing climate action is not an option. Tomorrow will be defined by the commitments we make today. ■

Weaning the world off fossil fuels

What is holding up progress on the transition to carbon neutrality, and what must we do to speed it up?

By Fatima Denton, Director, United Nations University Institute for Natural Resources in Africa (UNU-INRA)

Planning for a non-fossil-fuel future is not without its disruptions. The challenge resides not in what needs to be done, but on how to arrive at climate neutrality. The complexity in the direction of travel toward carbon neutrality is that the latter remains a contested term, and how it is interpreted and operationalized from region to region differs. There is also the fact that there are different responsibilities for climate change and that the pathway to a green recovery will be uneven. This, and the speed of travel, are helping complicate a decarbonization process that is weighed down before it sets off.

The world is adjusting to the economic turbulence that has decimated economies. It is clear that COVID-19 and its recovery might prove to be a formidable "rival" to the green recovery. This is especially the case for countries that rely on hydrocarbon resources as a vital stream of funding to support strategic Sustainable Development Goals (SDGs) such as education and health.

Consequently, the green recovery will have to compete with countries' efforts to rebuild and reboot their health systems and infrastructure. The context is not neutral: we are focusing on hydrocarbon-rich countries in Africa, many of which rely on revenue from oil and gas extraction and commercialization.

Ratcheting up the ambition in green initiatives

The disruption caused by COVID-19 could result in Africa's economy contracting by some 2.6%, or a loss of gross domestic product (GDP) of USD 120 billion. An estimated 25 to 30 million job losses are anticipated in both the formal and informal sectors. This economic fallout is being played out at a time of extreme vulnerability, when parts of the region are being assaulted by locust invasions against a backdrop of low crop yields and shortages of staple foodstuffs.

The pandemic has resulted in falling GDPs across the world in small and large economies alike. We witnessed a drop of 50% to 85% in oil prices in just one year. In addition, planned production of new oil discoveries has had to be put on the back burner as countries cut back on new investment plans. Consequently, the pandemic has not only "choked off" the vigor that economies in the North displayed before the crisis, it has also left hydrocarbon-based economies in Africa on their knees.

There is a sense that the massive deployment of renewables could be delayed in countries where energy poverty is rife due to competition for funding on other strategic sectors. Yet there is still a sense that, if leaders do not make a pre-emptive strike now and absorb the lessons from the exogenous shocks incurred by the crisis, then the opportunities for a managed transition could be lost.

Nonetheless, there are some valuable indicators of progress towards green development. For example, under a favorable tax system, the government in Kenya increased energy access from 25% of the population in 2013 to 75% in 2018. In addition, we have seen an increase in the uptake of decentralized solutions, such as solar systems, which continue to have a transformational impact on the lives of millions across Africa. But are these indicators enough to create the ripple effect of a world without fossil fuels?

Parallel journeys towards decarbonization

Countries across the world are recording steady progress in achieving carbon-neutral economies. Renewable options continue to grow as countries continue to assert energy autonomy and expand non-grid solutions.

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▲ Drilling wells for geothermal power in the Menengai Crater, near Nakuru, Kenya. The crater has an estimated capacity to generate 105MW of clean power. In the five years between 2013 and 2018, Kenya has increased energy access from 25% to 75% of its population

However, even with the falling costs of renewables and the meteoric expansion of digital innovations, the road to carbon neutrality is not without its challenges. For centuries, we have become fixated with fossil-fuel-powered economies. This is an addiction that might need a whole set of tools and a radically new approach to fix if our compulsion to overconsume natural resources is to be curbed.

Currently, leaders and their constituents are debating accelerating energy transitions. However, while the transition will differ in terms of orientation, speed, capacity, and autonomy, what might remain invariable is the need for new climate-resilient economies. In the case of Africa, it makes perfect sense for leaders and people alike to be faced with this wrenching contrast between development and environmental sustainability.

The continent's population will reach 2.5 billion by 2050. This calls for an urgent, pre-emptive response to deal comprehensively with rapid urbanization, massive degradation, and deforestation, as well as a range of energy-inefficient options that will rob the continent of its industrialization potential and slow down growth. Meanwhile, a twin phenomenon is being played out. Global agricultural exports have been declining for the past 40 years, while food imports have registered a worrying increase. From 2016 to 2018, Africa imported USD 35 billion of food per year; UNCTAD projects that figure to rise to USD 110 billion by 2025.

Africa's economic growth model is largely reliant on land-based extraction. The majority of people feed directly off land resources and are dependent on the land for their economic livelihoods. Similarly, the land is where the bulk of Africa's emissions come from, especially given deforestation, slash-and-burn practices, and commercial agriculture. Hence, there is a growing priority for the region to optimize its land

resources and to adopt land-based adaptation and mitigation strategies that will enable the sequestering of carbon, promote climate-smart mitigation, and reduce agricultural and other widespread deforestation.

If the land is a prime sector for mitigation and adaptation, energy systems are perceived as a driver for deploying renewable options and divesting from fossil fuels. It is true that poor access to energy limits growth and reduces the potential of certain social groups, particularly women and young girls. The stark contradiction is that Africa is abundantly rich in renewable energy options, but lacks the infrastructural power and capabilities to extend access widely.

However, while there are strong arguments for why green transitions make sense in Africa, not least to power growth, enable smart cities, and create green jobs, the truth is that many African countries do not see fossil-fuel use as problematic for sustainable development. Instead, their industrialization plans incorporate several energy options as part of the menu.

Oil and gas-rich countries in Africa are facing at least a temporary stranding of assets due to the collapse in oil prices, among other factors. UNU-INRA's recent study of stranded assets warns of an impending future where hydrocarbon resources in Africa will remain in the ground, depreciated and devalued.

Worryingly, many countries in Africa are intent on accelerating their returns from fossil fuels while they still can, as can be seen in plans for a 1,440-kilometer, crude-oil pipeline from Uganda to Tanzania and the new drilling projects in Namibia's fragile biodiverse hotspot, the Kavango basin. However, they are not alone, as the pattern has already been set by Europe and the US, where the appetite for natural gas is still growing. Indeed, according to Investigate Europe, current planned investments in natural gas infrastructure are estimated at €104 billion. Hailed as a bridging fuel, many with vested interests in Africa and beyond see gas as an important alternative, despite security and safety concerns.

Just transitions

Hence, although the call for a 1.5°C world will necessitate a radical transformation, much of what is being done at present by individual countries and regional groupings does not scratch the surface of the deep structural changes that are required consistently and collectively.

However, a justice-based transition must get the transitional imperatives right. We, as humankind, can tinker with innovative ways to fulfill the Paris Agreement so as to arrive at safe growth, but the tinkering cannot sacrifice justice for rapid mitigation at all costs. The task of meeting the Paris Agreement and staying within the 1.5°C temperature threshold has implications for equality. Speeding up the transition is an inherent function of power and capacity. Instead, the urgency should be weighed against those who can travel in the fast lane towards climate neutrality and enable poorer countries to muddle through innovative ways of managing a transition away from fossil fuels.

The notion of a just transition is often seen as an outcome of heavy fossil-fuel industries and the job losses and safety nets they will incur. However, a "just transition" is both process and outcome-based, requiring institutions, structures, and practices to be identified that reproduce climate injustice and expose poorer nations to a starker set of harder choices than those mature economies are able to make. Many countries in Africa are now contending with an economic downturn and are struggling to revitalize economies that are already saddled with debt and poor terms of trade.

The opportunity to bring forward the green transition and wean humanity off its addiction to fossil fuels is not an unattainable prospect. It can be seized, but getting it right and making it fair to those on the periphery of development will mean making deliberate attempts to ensure that the rest of the carbon budget is not eaten into by those who can eat it. Rather, the carbon budget should become a space protected by those for whom environmental sustainability is a prized asset, both for today and for future generations.

The road to carbon neutrality has new prospects for rapid African-led urbanization, leading to an Africa that is keen to get even with an industrialization process that has hitherto proved elusive. However, this trajectory will require support from developed countries to ensure that the mitigation burden is not offloaded on to poorer countries that are already paying for climate change externalities. Instead, the relevant climate finance needed, and the associated infrastructure, technology, and skills, should be frontloaded to "ramp up" trust and build effective burden-sharing coalitions.

COVID-19 is a stark reminder that the metaphor of the fork in the road, with its suggestion that there are choices, is changing. Instead, what we might observe is the road to carbon neutrality ending up becoming a cul de sac if we do not find the transitional tools that can enable us to make bold moves along two inseparable tracks: climate justice and the green recovery. ■

> ***"The carbon budget should become a space protected by those for whom environmental sustainability is a prized asset, both for today and for future generations***

Next generation of energy

Technologies like wind power and photovoltaic solar have advanced from expensive, subsidized, niche technology to wide-scale, commercially competitive solutions. We must learn from this rapid innovation to speed up the next generation of technologies

By Mechthild Wörsdörfer, Director, Sustainability, Technology and Outlooks, International Energy Agency

The adoption of the UN Sustainable Development Goals (SDGs) in 2015 united the world's focus on a number of fundamental challenges for the future of humanity:

- tackling climate change and delivering the Paris Agreement goals
- achieving affordable, reliable, sustainable and modern energy for all
- reducing the severe health impacts of air pollution, while ensuring prosperity across the globe

The energy sector sits at the heart of these challenges. For example, energy production and use emits three quarters of global greenhouse gases (GHGs). At the International Energy Agency (IEA), we are redoubling our efforts to help governments make good policy decisions in line with the SDGs. While we have many of the technology tools that we will need to make sustainable energy transitions a reality, we believe that innovation is key to completing the task and making it as smooth as possible for the world's citizens.

In the area of climate change, governments have significantly stepped up their levels of commitment. The number of countries announcing pledges to achieve net-zero GHG emissions over the coming decades continues to grow. Pledges to date cover around 70% of global gross domestic product (GDP) and carbon dioxide (CO_2) emissions. However, while

▲ President Moon Jae-in, Korea views a mockup for a hydrogen production plant to be built under the country's Green New Deal initiative. "Green hydrogen" is a major focus for energy innovation, with potentially unique applications for transport and steel manufacturing

global energy-related CO_2 emissions declined in 2020 by a record amount,, they are projected to rebound in 2021 to near 2019 levels. An acceleration of renewable energy deployment is needed to realize SDG target 7.2. In parallel, corporations and consumers will need to change their behavior and switch to cleaner energy sources. The availability of competitive and appropriate clean energy technologies is a key enabling factor.

Innovation to foster new tech and advance existing solutions

Net-zero emissions by 2050 will require further rapid deployment of available technologies and accelerated innovation for solutions currently at demonstration or prototype stages. Almost half of the emissions reductions needed to reach net zero by 2050 may need to come from technologies that have not reached the market today. The share jumps to three quarters for key sectors like heavy industry and long-distance transport.

Therefore, we will not be able to reach carbon neutrality by 2050 without significant leaps in innovation in a wide range of other clean technologies, some of which are still in a demonstration or pilot phase. This is especially urgent in those harder-to-abate sectors like heavy industry (steel, cement, and chemicals), shipping, and aviation. Here, cost-effective solutions are still lagging behind. Faster innovation is required, especially in electrification, hydrogen, bioenergy, and synthetic fuels, and carbon capture, usage, and storage (CCUS).

Despite the need for innovation, government research and development (R&D) spending as a share of GDP is not growing in major economies. In fact, it has fallen from 0.1% in 1980 to just 0.03% in 2019, and only a quarter of it is currently used on electrification, hydrogen, sustainable bioenergy, and CCUS. Despite some encouraging signs in the past three years, patenting activity in low-carbon energy technologies has largely plateaued since 2013, and has still not recovered the rapid growth rate it exhibited earlier this century. We need more support for R&D and innovation. In particular, for net-zero by 2050, around USD 90 billion of public money needs to be mobilized globally to complete a portfolio of demonstration projects before 2030. Currently, only about USD 25 billion is budgeted for that period.

// While competition will always drive innovation, countries must also work together to share knowledge, combine early-stage markets, and use funding efficiently

Reasons to be optimistic on innovation

1. Political momentum is high
Governments have the greatest capacity to take decisive action and shorten the time to bring new technology to market and to diffuse it widely. The political momentum is high. The US, China, the EU, and Japan are highlighting innovation in their net-zero pledges, and making clean-energy technology central to their plans for future prosperity. India is also currently drafting a new science, technology, and innovation policy, where clean energy innovation is expected to play an important role.

2. We're not starting from scratch
Significant progress has already been made in solar panels, wind turbines, electric cars, lithium-ion batteries, and LEDs. This has reduced substantially the costs of renewable electricity, electric cars, and efficient lighting. The successful examples of LEDs and lithium-ion batteries took less than 30 years to move from the first prototypes to the mass market.

In the process, we've learnt valuable lessons about how to reduce costs in technologies that rely much more on mass production than the energy technologies of the past. Offshore wind provides another example of how much has been achieved in the last 20 years. These must set the benchmark for the array of energy technologies needed to achieve net-zero emissions.

3. There are more paths to market
Energy innovators today have more available routes to success. This stems from the modular, distributed, or digital nature of many clean energy technologies, such as consumer products like cars and appliances.

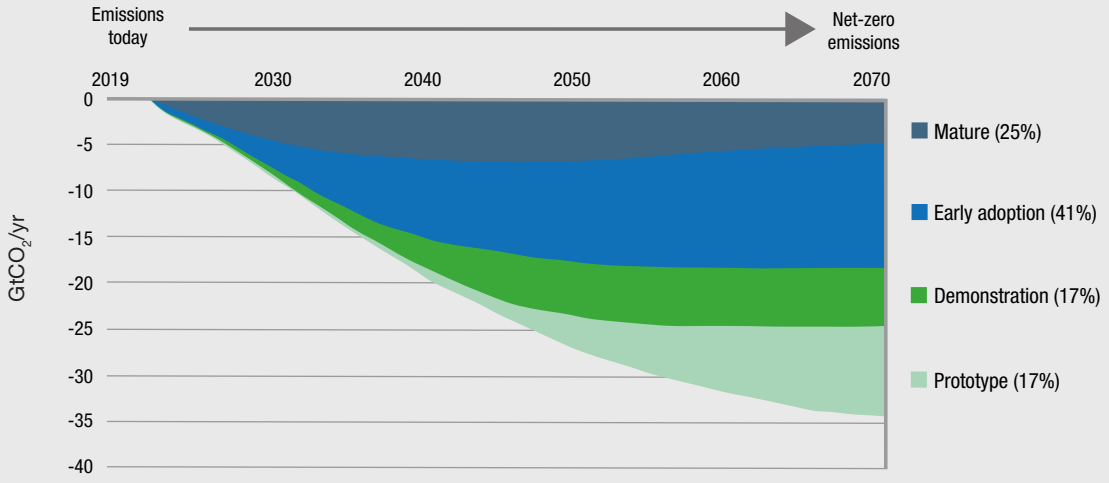
These types of technologies often lend themselves to scaling up via start-ups and venture capital investments. New electric vehicle manufacturers have attracted vast sums of risk capital in recent years and now major digital companies and philanthropists are allocating funds to start-ups in hydrogen and energy efficiency.

On the other hand, solutions for process technologies for materials production and the engines for ships or planes need large-scale solutions with plant-level economies of scale. These might most efficiently scale up via large corporations and public–private partnerships. Network technologies like smart grids might follow a hybrid model.

These different routes give governments more policy options and opportunities to experiment. Inducement prizes like the US American-Made Challenges and Canadian Women in Cleantech Challenge are breaking new ground.

4. Recovery packages can get overdue demonstration projects off the ground
Economic stimulus measures in response to the COVID-19 crisis offer an opportunity to take urgent action that could boost the economy while supporting clean energy and climate goals. Large-scale demonstration projects that mobilize investment and

FIGURE 1: Global energy sector CO_2 emissions reductions by current technology readiness category in the Sustainable Development Scenario relative to the Stated Policies Scenario



Notes: Percentages refer to cumulative emissions reductions by 2070 between the Sustainable Development Scenario and the Stated Policies Scenario enabled by technologies at a given level of maturity.

Technologies that are only at the large prototype or demonstration stage today contribute almost half of the emissions reductions in 2070 in the Sustainable Development Scenario

Source: IEA 2020

create jobs are an excellent example of this. Countries can actively lay the foundations for the industries of the future, coming out of today's crisis stronger and with the right bases towards a future of clean energy.

The US infrastructure plan proposes, among other things, demonstration projects for hydrogen, advanced nuclear, and carbon capture retrofits for heavy industry. The European Union's Innovation Fund is likewise investing in clean hydrogen and options for heavy industry, energy storage, and CCUS. Japan aims to demonstrate the world's first "hydrogen-based society." Other countries, including Australia, are also stepping up their efforts.

But we must address key challenges:

1. International cooperation

Commercial deployment of technologies that are not mature yet will rely on an unprecedented level of international cooperation. Analysis undertaken for the IEA's Net Zero by 2050 roadmap indicates that the transition to net–zero emissions could be delayed by several decades if countries don't work together. While competition will always drive innovation, countries must also work together to share knowledge, combine early-stage markets, and use funding efficiently. Mission Innovation, which has been relaunched this year, can play a central role in coordinating efforts and focusing on priority challenges. But other initiatives, including the IEA Technology Collaboration Programme and UN Framework Convention on Climate Change mechanisms, can be pivotal and enhanced by cooperation.

2. Long-term patient funding for R&D, including from the private sector

Today, many clean technologies that show potential in reducing emissions are still in the early stages of development. However, there is the need to fund longer-term challenges for which market uncertainty is likely to persist into the 2030s. Early-stage clean energy technologies, including direct air capture, synthetic fuels, or CCUS in some industry sectors, need to have the best minds focused on them. That means creating new incentives to reward R&D and breakthroughs wherever they arise.

3. Societal challenges, including the needs of emerging markets and developing economies

According to IEA modeling, three quarters of the emissions reductions needed to meet the Paris Agreement goals will come from emerging markets, developing economies, and China, compared with the current policy trajectory.

Meeting this challenge will depend on technologies that are appropriate for and adopted by companies and citizens in these countries. If they originate from innovators who understand the local challenges in these high-growth markets, they stand the highest chance of success.

The IEA's Clean Energy Transitions Programme works to reduce investment gaps in emerging and developing economies, improve the prospects for job creation through clean energy transitions, and help ensure people-centered transitions. ■

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Ramping up renewables

This Decade of Action demands a decisive shift from polluting to renewable energy. We need robust political, economic, and technological levers and deeper sectoral collaboration if we're to bring clean power to all

By Fei Teng, Associate Professor, Institute of Energy, Environment and Economy, Tsinghua University

The Paris Agreement calls for the world to limit temperature rise to no more than 2°C above pre-industrial levels, and to pursue efforts to cap it at 1.5°C. To achieve this goal, global investment and deployment in renewable energy must accelerate. Installations of wind turbines and solar photovoltaic (PV) cells must far exceed current levels for all major emitting countries. For example, if the US is to meet its 2050 carbon-neutrality target, it will need to increase the deployment rate of wind and solar PV by between 10 and 40 times compared with current levels.

For China to achieve its target of hitting peak carbon emissions by 2030, wind and solar PV installations would need to top 1,200 GW in 2030. That would be more than the current capacity of wind and solar PV installations globally, and would exceed the current total installed electricity capacity in the US.

To achieve such a challenging target at a global level, international cooperation must be strengthened in three areas. We must:

- strengthen cooperation in the global renewables supply chain, to continue to reduce renewable energy costs
- introduce a carbon price, through market mechanisms, to further improve the competitiveness of renewable energy relative to fossil fuels
- strengthen the research, development and construction of energy storage technologies worldwide to support high penetration of renewables

◂ Renewable electricity generation at Phan Rang, Ninh Thuân, Vietnam. The global deployment rate of existing renewable energy technologies, particularly wind power and solar PV, needs to accelerate massively if we are to cap global warming at 1.5°C

Reducing barriers

Renewable energy generation now accounts for around 30% of global electricity generation. The rapid growth of renewables has been driven by the substantial decline in generation costs in recent years. The cost of PV has fallen by 82% and concentrating solar power (CSP) by 47% in the last decade, while the cost of onshore and offshore wind has fallen by 39% and 29% respectively. The lower costs of onshore wind and PV compared with fossil power plants in most regions have made them the competitive choice for new power generation units. In most countries, onshore wind and PV can already compete with fossil energy without government subsidies.

However, in some developing countries, the development and deployment of renewable energy still faces significant barriers. These include:

- high costs of financing
- lack of incentive policies
- insufficient capital availability
- fragile grids
- lack of technical knowledge on renewable energy
- exchange rate risks

Addressing these barriers will require a different mix of policies, but the key remains to further cut the cost and increase the ease of access to renewable energy. The world must reduce green trade barriers to renewable energy technologies. It must further accelerate the reduction of renewable energy costs through global cooperation along the supply chain, and through economies of scale.

This cost reduction will not only benefit wind turbine and PV module-producing countries like China. It will also help those countries where renewable energy generation equipment is installed, as most employment and local benefits occur during installation, operation, and maintenance.

In addition, global North-South-South (trilateral) cooperation in renewable energy should be strengthened. This will accelerate the uptake of renewable energy in developing countries through technology and knowledge transfer. It will also facilitate the accelerated deployment of renewables in those countries through financial, technological, and capacity-building support.

Economic levers

At the same time, to make room for the accelerated development of renewables, the global installed capacity of fossil energy generation needs to be phased out. To this end, a pricing policy for carbon emissions is an effective policy tool that can be used at global scale. A recent study by the World Bank shows that many countries have already implemented carbon pricing policies through the establishment of carbon taxes or emission trading schemes (ETS).

The introduction of a carbon price could further increase the competitiveness of renewable energy generation. In the short term, the carbon price will increase the cost of electricity from fossil sources and therefore more electricity from renewable sources will be dispatched in the electricity market. In the long term, the carbon price will give investors more incentives to invest in renewable energy sources due to the increased profitability of renewable energy generation, further increasing the share of renewable energy generation.

However, it is also important to note that some countries do not have competition in the electricity generation sector. Introducing a carbon price therefore may not have an impact on the dispatch of electricity. There may also be a lack of mechanisms to pass the carbon price through to the electricity price. Carbon pricing policies therefore need to be implemented in conjunction with other policies that liberalize and introduce market competition in the electricity sector to promote the development and deployment of renewable energy generation.

Technical challenges

Achieving a future energy system with a high penetration of renewables also means having to solve a number of technical challenges. In particular, we need to reduce curtailment (capping renewable energy production at those times when supply exceeds demand) and overcome intermittency.

The overall rate of electricity curtailment shows a positive correlation with renewable energy penetration. For every 1% increase in renewables penetration, the average increase in the curtailment rate is between 0.02% and 2.97%. In addition, the power generation from renewable energy sources is affected by incoming wind and sunlight conditions and cannot be kept stable at all times. Solving this requires other technologies to regulate supply, incurring integration costs.

Energy storage technologies and smart grids offer solutions for future energy systems based on renewables. Existing storage technologies include short-term options (such as batteries) that can provide day-level capacity, and long-term options (such as compressed air storage), which can provide grid-level capacity. However, energy storage technologies currently face challenges such as cost and safety. Also, energy storage technologies are essentially energy conversion technologies that can also convert renewable energy into heat, hydrogen, and liquids for storage.

Energy storage, particularly batteries, has made huge technological advances over the last decade, with costs falling significantly. In the future, further collaborative research and development and industry cooperation can push costs down further and faster, boosting large-scale deployment of renewable energy storage. This will create the conditions for the further development of renewable energy. ■

Preparing for climate change

With the impacts of climate change ramping up, building resilience, particularly in developing countries and small island states, is now critical and urgent. We must convert our knowledge of climate solutions into priority actions now to achieve rapid and sustainable transformations

By David C. Smith, Director, Centre for Environmental Management, and Coordinator, Institute for Sustainable Development, The University of the West Indies

Waste, inequality, climate change, and biodiversity loss hamper progress towards the Sustainable Development Goals (SDGs). These factors are often linked: climate change damages coastal ecosystems and biodiversity through sea-level rise and storms. However, the poor are more affected by these events and recover more slowly from them, while exposure to repeated events increases income inequality.

> ***"The factors that make countries vulnerable are interlinked, as are the SDGs and their targets. Pursuing a single goal, even one of vital importance, is not recommended***

Climate change takes place unequally on the planet as well. In 2013, researchers from the University of Hawaii indicated that dates for departure from historical climate regimes varied markedly depending on location. Mangroves, coral reefs, and other important ecosystems found in the tropics and developing countries will quickly be exposed to new climates.

Unfortunately, the countries responsible for conserving those ecosystems are least able to manage them. Consequently, the ecosystems may degrade and the socio-economic systems they support will suffer.

Climate change has numerous effects. The average number of hurricanes in the Atlantic basin has increased. Droughts, wildfires, and the incidence of vector-borne diseases have risen. Research shows that increased high temperatures will affect health, sometimes causing death due to heat in tropical regions. Increased temperatures decrease economic productivity and increase the demand for energy to cool buildings.

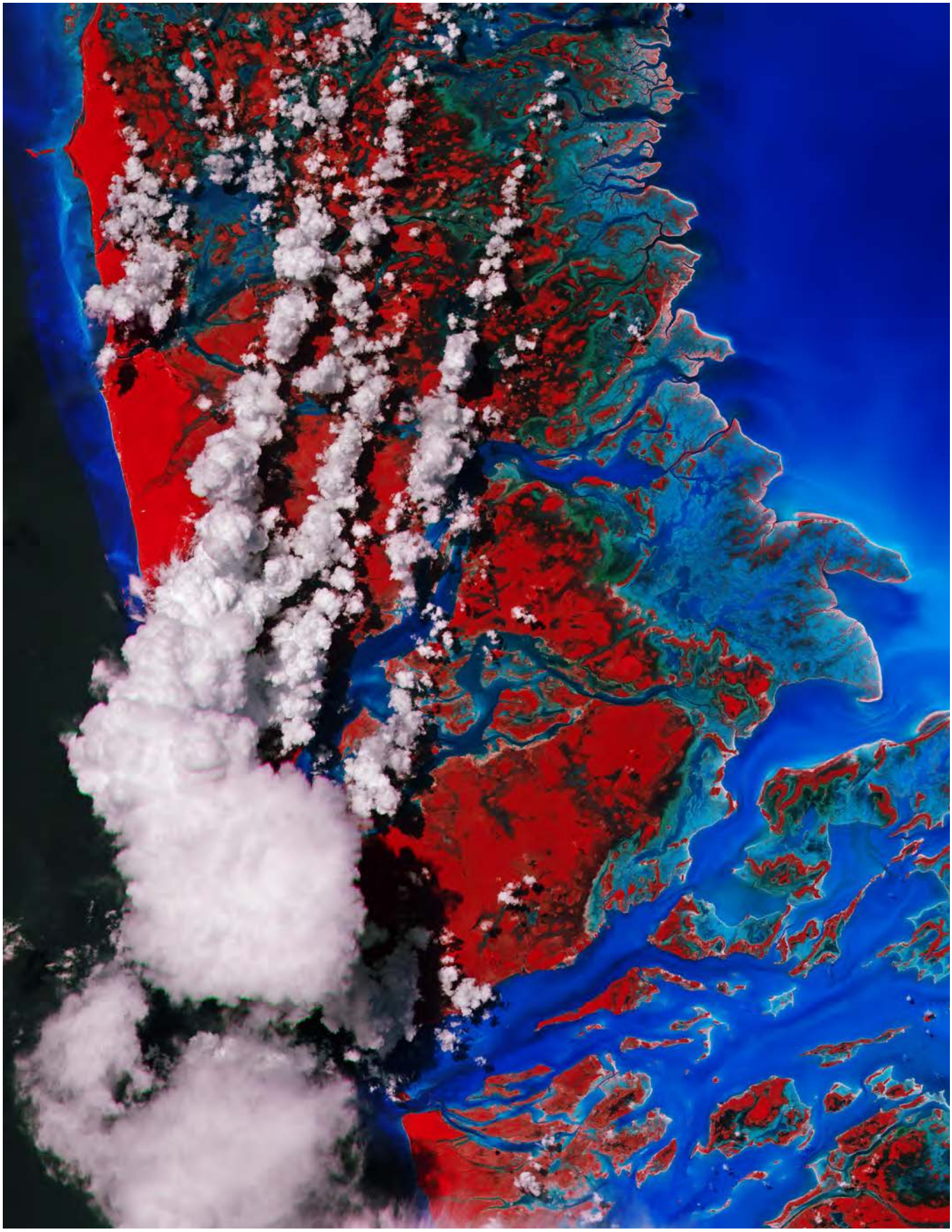
Tourism on Caribbean and Central American beaches has been damaged by vast mats of seaweed from the southern Atlantic. The amount of seaweed is increasing because of high ocean temperatures (partly caused by emissions from airplanes) and agricultural runoff from southern America and Africa. Tropical cyclones often cause catastrophic death and dislocation. But the effects of drought can be longer lasting, resulting in more lives lost and people displaced. Droughts and floods can disrupt food systems and biodiversity loss, increase water-borne diseases and other illnesses.

Many of these phenomena will be experienced in tropical countries first, particularly among small islands. Such countries have little capacity to deal with changing climates and have contributed little to the problem. Some are lagging in achieving the SDGs. They typically have economies dependent on exploiting natural resources rather than on highly developed human capital. They are more vulnerable to climate change and exposed to natural hazards in comparison to developed economies.

Some industries affected by climate change may not be acting to mitigate it. Coastal tropical tourism is highly vulnerable to sea-level rise, sargassum blooms, temperature rises, and tropical cyclones. However, flying in customers, and poor practices such as using large amounts of energy and water, and damaging reefs and mangroves are contributing to climate change and vulnerability. Some of these cannot be changed. But governments in tourism-dependent countries need to find ways of transforming the tourism industry to sustainability urgently.

The factors that make countries and communities vulnerable are interlinked, as are the SDGs and their targets. Pursuing a single goal, even one of

▶ Andros Island, the largest island of the Bahamas, in a false-color image taken shortly after Hurricane Dorian. The Copernicus Emergency Mapping Service was deployed to provide flood, risk, and recovery maps. Improved access to technology and the data it can provide will be critical for small island states' ability to withstand climate change



vital importance, is not recommended, since the linkages may lead to losses in other goals. The Global Sustainable Development Report suggests taking the linkages into account and pursuing entry points rather than individual goals. Increasing resilience should also manage trade-offs and capitalize on synergies. Resilience is increased when inequality is reduced, so addressing multi-dimensional poverty and providing social protection like universal access to healthcare and quality education builds resilience. Human capital is the most important component of nations' wealth, so increasing quality of education, improving access to education and increasing internet access for the rural and urban poor and for girls is vital.

Reports on the SDGs agree that it's better to focus on a few key areas rather than individual SDGs. Key areas include:

- decarbonizing energy
- creating sustainable cities and peri-urban settlements
- creating sustainable food systems
- creating just economies
- sustaining the global environmental commons
- increasing digital access

Each country should develop development pathways that increase resilience and make durable improvements to human well-being. For example, an efficient public transport system that uses electricity could reduce energy use and improve the sustainability of an urban center. Other possible actions are discussed below.

The next agricultural revolution?

Current agricultural systems cannot be upscaled to feed the world without exceeding planetary boundaries. So if we want to feed the world, we will need to transform the agricultural sector. Several companies are researching if they can reduce greenhouse gas (GHG) emissions associated with livestock rearing by culturing meat and animal proteins directly, rather than by rearing animals. Perfect Day, a manufacturer of dairy proteins (used to make cheese, ice cream, and other products), indicates that it creates 85% less GHGs than by using conventional methods. Other companies indicate substantial progress in creating meat and fish for consumers. These new technologies may not eliminate animal rearing, but can significantly reduce the emissions and land used by this branch of agriculture.

Toward zero-energy buildings

The University of the West Indies worked with local architects and builders to design and construct the first net-zero energy building for the Caribbean. It is a multi-use facility and uses techniques and materials readily found in the Caribbean, so it can be replicated. The building generates more energy than it consumes and is resistant to hurricanes.

> ***"Improving techniques to forecast weather, especially drought and extreme events, while extending information technology and insurance schemes for farmers, is important***

Harnessing technology and data

Developing countries may lack the resources to collect data needed to manage climate change and build resilience. Increasing access to technology such as anonymized cellphone data and remote-sensing data can track progress toward improving human well-being. It can also provide increased access to information and the tools to improve well-being in remote or impoverished areas.

In Guyana, a sizeable country with a small population, monitoring its tropical forest would be impossible without satellite data. Guyana has international agreements to manage its tropical rainforest to sequester carbon. Consequently, it analyzes freely available satellite data to measure the extent of forest and track progress towards SDG 13 (climate action) and SDG 15 (life on land). The system provides evidence for the effectiveness of national forestry actions and how well it is storing carbon and mitigating climate change.

Improving techniques to forecast weather, especially drought and extreme events, while extending information technology and insurance schemes for farmers, is important. Oxfam, Aon and others have been successful in extending parametric insurance to farmers in Kenya. Payments are dependent on data collected by satellite and are usually automatic. As a result, crop yields have increased, mainly because the risk of planting and experiencing financial loss due to crop failure has decreased.

A similar scheme was piloted by Oxfam in Sri Lanka and was also successful. The use of blockchain-based parametric insurance could be used to cover other risks. Payments based on satellite or other remote data would be a marked improvement over most current systems.

The Swedish Meteorological and Hydrological Institute uses cellphone towers to measure the amount of rain falling in Stockholm. The information produced is more accurate than most weather monitoring systems and uses existing and widespread technology. It could be applied to developing countries, which often have cellular networks but lack early-warning systems for weather events.

Addressing climate change will require innovation and a multidisciplinary approach based on good-quality evidence. For many economies and systems, upscaling what is being done currently will create major problems. A transformation is therefore required. This means scientists, businesses, government, and civil society must work together to implement solutions and build resilient societies. ■

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Respecting planetary boundaries

Climate is just one of nine identified "planetary boundaries," beyond which humanity's future comes under threat. We must ensure the SDGs succeed within these critical limits

By Johan Rockström, Director, Potsdam Institute for Climate Impact Research, and Professor in Earth System Science, University of Potsdam

Humanity flourished and developed into today's modern societies under the stable climate conditions of the last 12,000 years (the geologic period called the Holocene). During this period, Earth's temperature varied by no more than 1°C around the long-term average. The rise of complex civilizations relied on the relative stability that emerged on Earth, generating all the biophysical functions, from ecosystems to the seasonality of water cycles, which we depend on. Our journey of civilization over the past 10,000 years took us from the Neolithic Revolution (also known as the first Agricultural Revolution) to the Industrial Revolution.

▲ Coffee harvesting at the Pangoa Cooperative, Peru, on the edge of the Amazon Basin. The cooperative uses agroforestry techniques and is reforesting the land. In the event of 3-4°C of global warming, the Amazon rainforest could switch into degraded savannahs, losing more than 40% of its rainforest

That journey led to the increasingly excessive use of fossil fuels and natural resources like land and water.

This came at a price. Burning fossil fuels and converting almost 40% of the global land surface into cropland, meadows, and pastures has released large amounts of greenhouse gases (GHGs) into the atmosphere. Since the beginning of the Industrial Revolution, global levels of carbon dioxide (CO_2) have risen by 50% and are now higher than at any time in the past 3.6 million years.

The last time Earth experienced similar CO_2 concentrations, temperatures were 2.7°C to 4°C hotter and the sea level could have been 20 meters higher than today. Methane, the second most important GHG, has tripled since 1800. Consequently, the year 2020 was among the three warmest on record. Global mean temperature was 1.2°C above pre-industrial levels, sea-level rise accelerated, and the Arctic minimum sea ice extent was the second lowest ever recorded.

// The human dominance on Earth is extraordinary. The latest estimates show we have lost 68% of wildlife populations on Earth since 1970, in less than one human lifetime

The impacts of rapid population growth and explosive consumption extend far beyond climate change. We have lost nature at unprecedented speed through deforestation and industrial agriculture. Today, perhaps as little as 3% of the world's land remains free from human degradation. Global species extinction is 10 to 100 times higher compared with the average over the last 10 million years. Up to one million species face extinction. The human dominance on Earth is extraordinary. The latest estimates show we have lost 68% of wildlife populations on Earth since 1970, in less than one human lifetime.

At tipping point

The exponential rise in human pressures on Earth, relating both to human-induced climate change, over-exploiting of natural resources, and interference with global cycles of water, nutrients, and chemicals, has led to the scientific conclusion that we have entered a new geological epoch, the Anthropocene. Humans have become Earth's dominant force of change. For the first time since the rise of civilizations, humans face the real risk of destabilizing the entire Earth system.

Some biophysical elements of the Earth system have the potential to change abruptly to a fundamentally new state at some level of global warming. These "tipping elements" include the West Antarctic ice sheet, which may irreversibly start to collapse on millennial timescales at 1.5°C to 2°C of warming. The Amazon rainforest could switch into degraded savannahs at 3°C to 4°C of warming or more than 40% deforestation. Potentially, the Amazon's tipping point could happen at 20% to 25% deforestation when global warming interacts with ecological degradation.

The Amazon's shift from a tropical rainforest into grasslands could happen within as little as 50 years. The latest assessment shows that the Brazilian Amazon, over the past 10 years, has already flipped from being a carbon sink to a carbon source, due to deforestation, forest fires, and droughts.

Tipping elements do not operate in isolation, but as sub-systems of the entire Earth system, interacting at global scale. There is now rising concern that one tipping point may lead to the shift in other tipping elements in a so-called "tipping cascade." This would cause catastrophic, runaway climate change that would not stop even if we halted emissions overnight.

Safe boundaries?

These scientific insights show that we have entered the Anthropocene, and that pushing the Earth too hard can send systems beyond critical thresholds, triggering irreversible trajectories for the entire planet. Yet, we remain dependent on the continuation of the Holocene as the only state we know for sure can support our modern world. This leads inevitably to the necessity of defining a safe operating state that can continue to support humanity. Or, in short: what will it take to keep Earth in a Holocene-like interglacial state?

To address this, we must answer two questions. First, what are the biophysical systems and processes that regulate the state of the planet and the functioning of life-support systems in the biosphere? Second, for each of these systems and processes, can we scientifically define "safe boundaries?" By safe boundaries, we mean those beyond which we risk triggering non-linear dynamics, causing feedbacks that can lead to a planetary drift away from a manageable Holocene-like state. At the same time, they are boundaries within which we have a safe space delineated by scientifically defined targets (or boundaries) for a high likelihood of maintaining an Earth system that can support world development. This is the planetary boundaries framework.

Scientists have identified nine key planetary boundaries in the Earth system. These nine systems and processes contribute to regulate the state and functioning of the Earth system. They are:

- climate change
- biodiversity integrity (genetic and functional diversity of ecosystems and their functions)
- ocean acidification
- depletion of the ozone layer
- atmospheric aerosol pollution
- biogeochemical flows of nitrogen and phosphorus
- freshwater use
- land-system change
- release of novel chemicals

We have already pushed the planet outside the safe operating space for four of the nine boundaries. Among them are climate change, considered a "core boundary," and biosphere integrity. Each has the potential to shift the Earth system into a new state if permanently and substantially exceeded.

Realigning the SDGs

Our global vision for sustainable development is expressed in the 2030 Agenda with its 17 Sustainable Development Goals (SDGs) that UN Member States adopted in 2015. These have created a framework for national action and global cooperation on sustainable development. The SDGs provide time-bound targets for prosperity, people, planet, peace, and partnership to guide national action and global cooperation.

Like the tipping points, they are also deeply interconnected. The achievement of one goal can influence the feasibility of achieving other goals. Transitioning towards sustainable and resilient societies strongly depends on maintaining a stable planet and responsible stewardship of natural resources. Sustainable land use, oceans, and food systems have been identified to be among the most important enabling conditions for achieving the SDGs.

This means that, with the SDGs, humanity has for the first time agreed on a global development path that integrates aspirational human development goals with a stable and resilient planet. In fact, the SDGs explicitly include four of the nine planetary boundaries: freshwater (SDG 6), climate (SDG 13), oceans (SDG 14), and biodiversity (SDG 15). What's more, the Goals implicitly include all of the boundaries, through:

- SDG 2 on sustainable food systems (the land and nutrients boundaries)
- SDG 7 on clean energy (the aerosol boundary)
- SDG 12 on sustainable consumption and production (several boundaries)
- SDG 11 on sustainable cities (the novel chemicals and ozone boundaries)

The challenge is that the SDGs that cover planetary boundaries are not quantified. So there is an urgent need to integrate quantitative science targets for all planetary boundaries within the SDG framework. We must recognize the deep paradigm shift that is required: to truly meet the goal of healthy people on a healthy planet, we must achieve the SDGs within planetary boundaries.

We need bold transformations

Underlying almost all the transformative changes outlined by the SDGs is the decoupling of human well-being and socio-economic development from environmental degradation. This is the only way to meet the Paris target of reducing GHG emissions to zero by mid-century.

However, climate and Earth system science increasingly show that the success or failure of the Paris Agreement does not depend solely on whether the world will achieve full decarbonization. It also depends on whether we can preserve and expand carbon sinks in natural ecosystems at the same time.

Since the onset of industrialization, land and oceans removed and stored about 60% of all the CO_2 emissions from burning fossil fuels and land use change. This is despite annual emissions increasing 16-fold between 1850 and 2019. If humanity loses this extraordinary climate protection provided by nature, we will have little chance of achieving the Paris climate goals, and therefore the SDGs.

Our future on Earth will depend on our ability to maintain a stable planet that continues to support life and human well-being. Rapid climate change multiplies the threat to biodiversity and human well-being. Only by achieving the Paris targets can we open the door to a sustainable future envisioned in the SDGs. This requires deep transformations in the way we produce and use energy, trade, consume, eat, and interact with nature.

Given the essential contribution of nature to limit global warming to levels compatible with a sustainable future for humanity, it will be critical to better integrate the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD). Only healthy ecosystems will be able to continue to absorb large amounts of CO_2. Only well-connected, heterogeneous, and diverse ecosystems are resilient enough to do so under the levels of climate change that is already unavoidable.

We need to design integrated solution pathways within planetary boundaries that ensure any necessary social transformations catalyze change towards inclusiveness and sustainability. We need to act bold and fast as we move towards recovering from the COVID-19 pandemic, which has reversed most achievements made since the adoption of the SDGs in 2015.

2021 brings three major international meetings: COP15 of the CBD, COP26 of the UNFCCC, and the UN Food Systems Summit. Governments, meanwhile, are pledging huge amounts of fiscal spending for long-term economic recovery. We have both the opportunity and obligation this year to finally change the course of history towards prosperity and environmental sustainability for all. We must take it. ■

// We must recognize the deep paradigm shift that is required: to truly meet the goal of healthy people on a healthy planet, we must achieve the SDGs within planetary boundaries

Sustainable mining

How can we ensure that a healthy extractives industry delivers on the SDGs?

By Lisa Sachs, Director, Columbia Center on Sustainable Investment (CCSI), Columbia University; Martin Dietrich Brauch, Senior Legal and Economics Researcher, Columbia Center on Sustainable Investment (CCSI); and Antonio M.A. Pedro, Director, Subregional Office for Central Africa, United Nations Economic Commission for Africa (UNECA)

With leadership in Europe and Asia, and with the US finally back at the table, we are on the cusp of the energy and digital transformations needed to avoid climate catastrophe and to achieve the Sustainable Development Goals (SDGs). In the coming years we will see a massive deployment of solar and wind farms, electric vehicles, and mobile platforms that allow for telehealth and remote education, among a proliferation of new technologies for our carbon-neutral and increasingly digitized future.

Believe it or not, this leap to the future will require a scale-up in one of our most basic and ancient practices: the primary extraction of minerals and metals. But not all minerals – fossil fuels are overdue to be phased out. They are clinging to life because of short-termism in the market, reckless climate denialism,

misinformation campaigns, and the inertia of politicians and bankers whose campaigns or bonuses are bankrolled by the sector and their short-sighted profits. It's more complicated in countries currently dependent on coal, oil, or gas for their economic development. The rest of the world, meanwhile, has a responsibility to pave the path for a just transition from fossil fuels to sustainable energy and livelihoods.

But for many minerals, it's a different story. Wind turbines, solar panels, battery storage, mobile phones, and other technologies, combined with rapid urbanization, automation, infrastructure development, and population growth, mean we can safely forecast a much greater need for so-called critical minerals. These are minerals required for a range of existing zero-carbon technologies and, therefore, understood to be core to our net-zero-carbon future. Indeed, they may be the minerals in which we might expect the greatest near-term demand growth – though in this era of rapidly changing technologies, materials, and approaches, the "criticality" of these minerals may also keep shifting.

◂ Students at the secondary school in Khanbogd, Mongolia. The school and city are growing rapidly due to investment in the Oyu Tolgoi copper and gold mine. The mine, co-owned by the government, is Mongolia's largest industrial project

Mining and development

Mining has always been at the heart of the sustainable development challenge. The materials produced are the building blocks of our economies, from roads and bridges to wind turbines and satellites. For many countries rich in resources, the revenues expected from these resources are the primary source of public income, and therefore for financing public goods (health systems, education, water and sewage systems, electric grids, and so on). The mining sector can create jobs (though not as many jobs as often hoped and subject to the changes resulting from increased automation). Upstream, downstream, and knowledge linkages, which remain woefully underdeveloped in most resource-rich countries, can deepen their participation in global value chains. Through local supply chains, skills training, and project-related services, the sector can create local opportunities and livelihoods, including by fostering the emergence of competitive small and medium-scale enterprises. If properly managed, it can build service sectors that are transferable to other sectors of the economy, deepening economic resilience beyond the currency of mining.

Though too often overlooked, mining can also play an instrumental role in expanding the affordability and accessibility of infrastructure and in fostering resource-driven industrialization, diversification, and economic development, locally and regionally. Mining requires substantial power, roads, rail, ports, water, and information and communication technology (ICT) systems.

These projects often take place in areas where infrastructure networks are underdeveloped. Historically, mining companies have built the infrastructure needed for their projects, and excluded other users because of the perceived inefficiencies and complexities of allowing other users to share access.

But the potential gains from sharing mining-related infrastructure are enormous. Building in extra capacity to a rail network can unlock an agriculturally rich region to export markets and ease the import of key inputs, like seeds and fertilizers. A project's need for massive and reliable power, even or especially in remote areas, can anchor the development or scaling of new off-grid renewable energy projects that bring clean energy to otherwise energy-poor regions.

> ***"A project's need for massive and reliable power, even or especially in remote areas, can anchor the development or scaling of new off-grid renewable energy projects***

Projects can also anchor demand to expand national grids. In turn, more robust energy systems, along with other types of physical as well as soft infrastructure, allow for industrialization. This can include the development of energy-intensive industries, such as the production of green hydrogen, steelmaking for wind turbines, and the production and recycling of batteries

that are critical for the deployment of zero-carbon energy technologies. Mining, energy and other infrastructure, and industry can therefore work together as gears in an engine of zero-carbon economic development for resource-rich countries.

Mitigating impacts

Mining is at the heart of the sustainable development challenge as much for its impacts as for its potential. Mining projects are resource intensive. They require large swaths of land, and sometimes the displacement of communities or other livelihoods. They may compete for water with local or downstream uses and users, including traditional agriculture or even clean, safe drinking water.

Projects inevitably impact the environment, including disruptions to biodiversity and ecosystems. These impacts have been and will continue to be exacerbated by climate change, adding the challenges of water stress, floods, and other documented impacts of climate change on workers' health and productivity. Greater demand will create greater impacts, as mining pushes into new frontiers, expanding into new territories or requiring more energy and resources to deepen the production of existing reserves.

Mining has the potential to catalyze sustainable development, through taxes and royalties, local procurement or processing, expanded access to infrastructure, capacity-building, industrialization, and so on. Yet those benefits have been slow to materialize in most parts of the world. The sector has been plagued by corruption and mismanagement, conflict with local communities, devastating "shortcuts" and lack of capacity to prevent and manage social and environmental impacts, and lack of coordination among public and private actors. While the long-term interests of companies should align with the long-term interests of their host communities (stable projects, locally available skills and resources, and a profitable project), short-term interests do not always align. Nor do the interests of company shareholders, often willing to externalize costs to maximize profits, align with local interests to avoid impacts, and share in the benefits.

> ***"National governments as well as regional and continental organizations should localize the SDGs through "green new deals"***

Towards a sustainable future for mining

The Decade of Action brings a clarion call to the mining sector, both to the industry actors and those who support, finance, and govern the sector. Mining's role in achieving the SDGs is central but not linear. Our ability to produce existing and future technological solutions depends on resource availability, which in turn depends on the sector's ability to supply minerals sustainably.

Companies must urgently:

- switch to net-zero-carbon energy
- address deforestation, biodiversity loss, and other ecosystem impacts by applying the mitigation hierarchy
- use water efficiently and responsibly, including by (re)using waste-water and treating the water they use before discharging it
- conduct climate risk assessments and community vulnerability assessments, and develop accompanying management strategies and plans
- engage meaningfully with and secure the law-abiding consent from affected communities
- improve recovery of minerals from traditional "waste" during production
- invest in material recycling and reclamation

Companies share responsibility with their government partners, suppliers, and downstream customers to protect the environment and human rights, including rights to health, living wages, and worker representation. These considerations should be integrated in companies' core business models and reported on as such.

The financialization of commodities contributes to the decoupling of commodity prices from demand and supply dynamics, further distorting price dynamics and market signals. In this regard, accountants, traders, investors, and regulators each have an important role in ensuring that commodity prices reflect their unabated social and environmental costs.

The SDGs provide an instrumental guide and a practical tool for this Decade of Action. Rather than showing how existing activities map to specific goals, companies should seek to understand the transformations required to achieve them. In line with the so-called "sustainable development license to operate," they should orient all business operations and activities toward achievement of the SDGs. At a practical level, the SDGs can create a common platform for companies, investors, governments, regional banks, and development partners to collect and assess development needs, coordinate interventions, monitor impacts, facilitate stakeholder engagement and participation in decision-making, and adapt programs as necessary.

To realize the potential contribution of the mining sector to achieving the SDGs, appropriate governance mechanisms also need to be put in place. National governments as well as regional and continental organizations should localize the SDGs through "green new deals." These are law and policy frameworks that outline, for specific national and regional contexts, how to define, encourage, and regulate climate and SDG-aligned investments from public and private sources. They should lay out guidance and rules on how the mining sector will work, not in isolation, but alongside other key parts of the economy, to achieve the vision of a climate-neutral, inclusive, sustainable future. ■

Farming for the future

Origin Green is creating a template for sustainable food production in Ireland that is science-based and quantifiable

By Deidre Ryan, Director Origin Green and Sustainable Assurance, Bord Bia

As we emerge from a challenging year, I am proud to see how our Origin Green members continue to innovate and develop their sustainability business plans, offering consumers more sustainably produced food and drink products.

Origin Green is Ireland's food and drink sustainability program, driving sustainability improvements across the entire supply chain from farmers to manufacturers, to foodservice and retailers. Collaboration is at the heart of what we do, and it is critical to acting sustainably – recognized in #17 of the Sustainable Development Goals. Origin Green aligns with 15 of the 17 SDGs, and to further support this, Bord Bia (the Irish Food Board) became a UN Global Compact member in 2018.

Presently, we are six years on from the adoption of the SDGs in 2015 by all UN Member States and now have nine years remaining to achieve our ambitious targets. SDG 17, Partnership for the Goals, reiterates the importance of coming together to implement sustainable development. Partnership has always been part of Irish food production, small family farms mean that neighbors help one another – we even have a name in the Irish language for this, "meitheal," meaning a team of mutually supporting workers.

Driving change

As a country with family farming traditions and lush green pastures, Ireland has a history of being recognized as sustainable. However, Origin Green strives to create proof-points behind that. The program connects all parts of the supply chain: 54,000 farms, 300 food producers (representing over 90% of our exports), the government, and international NGOs. Our mission is to prove and improve the sustainability of the food we produce to meet the evolving needs of global customers and consumers, while conserving our natural resources. Origin Green shows that Irish food and drink producers have a sustainability plan, that they are driving change, and that it is independently verified.

© Bord Bia

Bord Bia has established the world's first national grass-fed standard, independently verifying the proportion of grass in livestock diet

Our member companies have set over 2,400 sustainability targets. Throughout the country, over 100 independent auditors undertake 650 weekly assessments on farm as part of our Sustainable Assurance Schemes. The Origin Green program continues to play a pivotal role in evolving the advancement of the SDGs within the Irish food and drink industry.

We are going further by creating a cohort of future leaders in sustainability. This year will see the 50th Origin Green Ambassador appointed as part of our Talent Academy. Collectively these future leaders have undertaken over 100 projects with companies in 14 countries. We continue to evolve, most recently establishing the world's first national grass-fed standard independently verifying the proportion of grass in our dairy and beef herds' diet.

As we emerge from the COVID-19 pandemic and realize the realities of climate and biodiversity crises, we must all come together as a planet to advance Agenda 2030.

With the UN Food Systems Pre-Summit taking place this July, it is vital that, as food producers, we recognize our role and take the lead in transforming food production systems, making them more resilient and sustainable. Bord Bia's ongoing development of the Origin Green program showcases our commitment to promoting the delivery of the SDGs within the Irish food and drink industry. ■

For more information, visit:
www.origingreen.ie

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Feeding the world sustainably

To balance the combined pressures of climate change and growing populations, we need to re-evaluate what we eat and where and how it's grown

By Ken E. Giller, Professor of Plant Production Systems, Wageningen University, The Netherlands

Imagine a world free of poverty (Sustainable Development Goal 1) and hunger (SDG 2). To achieve this "double zero" within planetary boundaries (SDG 15) in the face of the visible impacts of climate change is perhaps the greatest challenge of our time.

It is also a challenge to which each one of us can contribute. We can change our diets and reduce the amount of animal-based products we consume. The amount of food lost at or after harvest, wasted along the value chain, or left on our plates is shocking and must be reduced. Yet even the most conservative projections suggest we need to produce at least 20% more food to match global demand by 2050. Many even consider the world will need to increase food production by 50%. Clearly, more must be produced to match the demand for nutritious food for all. But where and how can this be achieved? And who are the farmers who will feed the world?

To understand where there are opportunities to produce more food, we can learn from how the world has kept pace with its growing human population until now. Over the past 60

◂A traditional food market in Nyaung Shwe, Myanmar. Myanmar, part of the "green revolution" in Asia, has dramatically improved food productivity over the last three decades and met the MDG 1 target on reducing hunger

years, yields of the major staple cereals have increased dramatically (Figure 1). Compared with 1961, we now produce up to four times the yield of cereals harvested per hectare in Latin America and roughly two and a half times as much in Europe and Asia. The area of cropland harvested has also increased strongly in Latin America and Asia, but by contrast has fallen in Europe. Yield increases in Africa have been more modest, where the food demand for the growing population has largely been met through the expansion of agricultural land and importing food.

Rather than simply bemoaning the lack of past increases in crop productivity in Africa solely as a failure, we can also see it as an opportunity. It is an opportunity to understand why Africa has diverged from other regions, and an opportunity to increase crop yields in Africa and narrow yield gaps in future.

A tale of many continents

Before we consider these questions, let's take a step back and reflect on the farmers who produce our food. The vast majority of farms globally are still family enterprises, although this is changing rapidly in many wealthier countries.

The number of farms has fallen dramatically in Europe and North America where less than 2% of the population is involved in farming. The tight economic margins of food production lead to the continuing expansion of farm areas and a decline in numbers of farms. By contrast, there are around 500 million small-scale (less than two hectares) producers in low and middle-income countries, and the numbers continue to rise. When we consider their households, this means that between two and a half and three billion people depend, at least partly, on agriculture for their livelihoods. Many of these rural households are both poor and hungry, which is why SDG 1 and SDG 2 are inextricably interdependent.

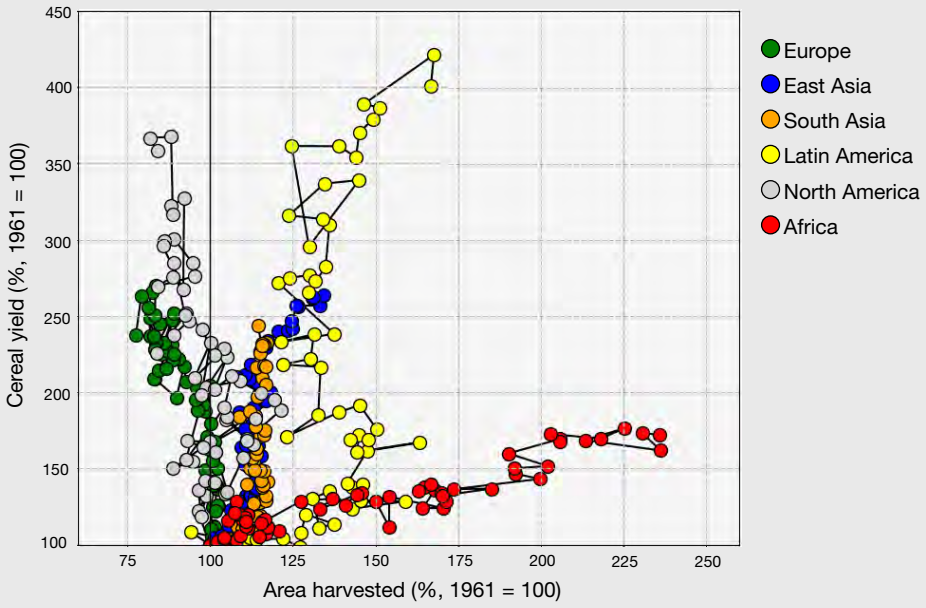
So why has Africa fallen behind Asia in terms of crop productivity and outstripped it in the incidence of poverty? Many papers and books have been written on the success of the green revolution in Asia, which resulted from major government investment in rural development in general and cereal farming in particular. Many Asian countries have achieved food self-sufficiency based on their own production, as well as bringing down the incidence of poverty dramatically.

Although many of the gains in crop productivity in Asia result from the opportunities for irrigation, which allows for several crops each year on the same land, this cannot explain all of the divergence in trajectories. Clearly the lack of consistent government investment in rural development in African countries has also played a major role.

If we look to the future, the population in Asia is starting to plateau. But in sub-Saharan Africa, populations continue to grow rapidly: UNDESA projects the population to increase by 305 million in the decade to 2030, rising to 1.4 billion. Across the African continent there is a burgeoning demand to provide nutritious diets for the rural and urban populations. We thus have a peculiar situation where there is a clear opportunity to increase crop productivity to meet this demand. At the same time there are several key problems to solve:

- achieving national food security
- tackling rural poverty through providing extra income for rural households
- providing extra employment throughout the food system
- reducing dependence on imports to help the balance of payments

FIGURE 1: Past intensification and area expansion trajectories of staple cereal production across different regions of the world



Data is shown in relation to the base year of 1961 and the lines track the trajectory from year to year

Analysis by João Vasco Silva based on FAOSTAT

The food security conundrum

Yet, sustainable intensification to narrow yield gaps is not taking off in Africa. Why? Because of the small and fragmented farm sizes, inadequate rural infrastructure, and the lack of an enabling socio-economic environment. This is what I have termed the food security conundrum of sub-Saharan Africa. The smallholder farmers who predominate are often "reluctant farmers" who seek more remunerative employment opportunities off-farm.

To unpack the problem further, the underlying and pervasive problem that constrains agricultural productivity in Africa is the lack of soil nutrients. Although we should not underplay the importance of the climate crisis, which is exacerbating extreme weather events such as floods and droughts, tacking poor soil fertility is key. This is illustrated by the paradoxical situation where some of the most food-insecure regions are those with highly favorable conditions for agricultural production.

For example, the inherently fertile soils of the East African highlands where the bi-modal rains allow two cropping seasons each year attracted early settlement for agriculture. Rapid population growth and land subdivision over generations coupled with intensive cultivation with few inputs has exhausted the natural fertility of the soil and led to declining productivity. This gives rise to a double poverty trap of small farms and poor soils. By contrast, in some regions with drier climates and inherently poorer soils, but where populations are less dense and farms are larger, a much larger proportion of households are food secure.

So how can this food security conundrum be tackled? Raising food prices is not an option as affordable, safe, and nutritious food is needed for both the urban and rural poor. Also, many rural households are net buyers of food (they consume more than they produce). If we are to learn from Asian experiences, a whole raft of different approaches is needed to ensure stable incentives for producers and access to food for the poor.

This is one important conclusion of an eDialogue: What Future for Small-Scale Farming that the Sustainable Development Solutions Network (SDSN) hosted over several months in 2020 together with Foresight4Food, IFAD and APRA (Agricultural Policy Research in Africa).

> ***"There are promising signs in the expansion of small towns and cities in rural areas of Africa, creating urban markets that can help support the diversification of livelihoods***

We should not forget that many Asian countries still face major challenges. Figures from The State of Food Security and Nutrition in the World 2020 show that there are many more poor and undernourished people in Asia (1.03 billion) than Africa (674 million). In India, 70% of small-scale farms are ultra-small (less than 0.05 hectares) and yet are still important for families' nutrition and livelihoods. What we call smallholder farmers are a very diverse group, but it is clear that many cannot make a living from farming alone. They depend on family members earning income outside the farm in many shapes and forms, from small-scale enterprises and rural wage labor, to jobs in urban areas.

Agriculture is a still a key source of smallholders' food and income, so finding ways to increase productivity and farm incomes are key to addressing both poverty and hunger. How best to do this is a matter of debate. An attractive approach is based on sustainable intensification through diversification. By increasing crop diversity beyond the basic staples (cereals, roots, tubers, and bananas) to include more nitrogen-fixing legumes and vegetables, multiple benefits can be gained in productivity, soil fertility, and nutritious diets. Decades of underinvestment cannot be addressed without additional nutrients. Achieving this requires not just different crops, but also a focus on integrated soil fertility management to efficiently recycle nutrients within the farm through organic manures, and supplementing with inputs of nutrients through mineral fertilizers.

Solving the conundrum?

The big question at the heart of the food security conundrum is of course how to make all this happen. It is clear that African governments need to make firm commitments to tackle poverty in rural areas through investing in agriculture, and to create jobs to relieve the pressure on land. This needs a whole raft of policies and actions to address the issues highlighted above. There are promising signs in the expansion of small towns and cities in rural areas of Africa, creating urban markets that can help support the diversification of livelihoods. Another positive development is the focus on regional markets through the African Continental Free Trade Area.

This is a problem that concerns us all. As we have seen, the goals of zero poverty and zero hunger go hand in hand, as the majority of the rural poor are small-scale farmers by default. The opportunity for agricultural development to support the broader development of African economies is clear, as is the need for concurrent job creation in other sectors.

The rural population in Africa continues to grow rapidly, doubling every 20 years. Intensifying agriculture is therefore fundamental to preventing further land use change and conversion of natural habitats to agriculture. It is also fundamental to allowing current and future generations to earn a decent living. ■

Restoring land

We know how to restore land, and the benefits it brings to communities, climate, and biodiversity. Countries must act on land restoration now

By Marion Ferrat, Senior Policy Expert, SDSN; and Micheline Khan, Biodiversity Analyst and Program Manager, SDSN

With accelerating climate change and biodiversity loss, the world is facing two complex and closely interrelated crises that require urgent action. The UN Framework Convention on Climate Change and the UN Convention on Biological Diversity provide established global frameworks and goals. But countries, businesses, and communities globally must now act to drive concrete action at the local level.

The restoration of degraded land is important for multiple environmental, social, and economic reasons. It needs to be scaled up and integrated with other efforts under a joint agenda for action on the Sustainable Development Goals (SDGs).

▲ Community mangrove planting around Kampot and Kep, Cambodia as part of a wider coastline conservation project. Mangroves are among the most productive marine ecosystems on the planet

Tackling the ongoing degradation of land

Land degradation is one of the main drivers of both climate change and biodiversity loss. This occurs mainly

through deforestation, wildfires, and soil degradation, which cause the release of greenhouse gases into the atmosphere. The conversion of primary forests to managed forests, illegal logging, and unsustainable forest management are also contributing to increasing emissions and biodiversity loss.

In its Special Report on Climate Change and Land, the Intergovernmental Panel on Climate Change (IPCC) noted that over a quarter of the Earth's ice-free land area is already degraded by human activity, undermining the well-being of 40% of the world population. This has led to an unprecedented level of biodiversity loss and over-exploitation of the world's ecosystems (as noted by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) in its Assessment Report on Land Degradation and Restoration).

Land degradation also deeply affects communities and their livelihoods. It reduces land productivity and increases extreme weather events such as wildfires and floods, and their associated economic costs. Land degradation and climate change together could reduce global crop yields by 10% by 2050, increasing to 50% in some regions, according to IPBES.

Populations living in degraded areas are particularly vulnerable as they directly depend on natural resources for their subsistence, food security, and income. As the IPCC notes, this exacerbates existing inequalities and disproportionately affects women and youth. Land degradation and climate change are "threat multipliers," leaving already precarious populations highly sensitive to extreme climatic events, with consequences such as poverty and food insecurity.

Countries must prioritize land restoration

The impacts of land degradation on biodiversity and climate have sparked ambitious objectives for land restoration at national, regional, and global levels. The benefits of land restoration for ecosystem resilience, local communities, nature, and biodiversity are broadly recognized.

The International Union for Conservation of Nature (IUCN) estimate that land restoration could contribute to over a third of climate change mitigation required to meet global targets under the Paris Agreement.

A range of initiatives are already in place, from the ongoing UN Decade on Ecosystem Restoration to the New York Declaration on Forests, which seeks to restore 350 million hectares worldwide by 2030. Over 120 countries have engaged with the UN Convention to Combat Desertification on the 2018 to 2030 Strategic Framework to achieve land degradation neutrality and agreed to formulate voluntary targets.

These global efforts emphasize the long-term commitment needed to restore land and nature and must be complemented by targeted, nationally appropriate policies and measures in-country. Acting early can minimize risks, reduce losses, and generate immediate benefits to affected communities. However, only 1% of finances globally are directed toward restoration of the environment – even as it was found to be one of the most cost-effective approaches to absorb and store carbon dioxide (CO_2) from the atmosphere. According to Strassburg et al. (2020), restoring 15% of converted lands in priority areas could sequester 299 billion tons of CO_2, or 30% of the total atmospheric CO_2 increase since the Industrial Revolution. This could serve as the foundation for ambitious 2050 global conservation and climate mitigation agendas.

> *"Global efforts emphasize the long-term commitment needed to restore land and nature and must be complemented by targeted, nationally appropriate policies and measures*

Making land restoration a reality

Experts, UN agencies and practitioners are broadly in agreement on what is needed and known to make land restoration possible. Implementing known sustainable land management (SLM), restoration and rehabilitation practices should be a priority for countries. As the UN Convention to Combat Desertification explained in its 2017 report, SLM involves a range of technologies and practices and integrates local biophysical, socio-cultural, and economic needs and values in decisions to holistically achieve long-term productive ecosystems.

Actions for land restoration are primarily focused on soil and water conservation, including the management of vegetation cover and soils, for example through tillage practices or nutrient supply to rebuild soil carbon, and agroforestry practices. Physical methods such as building terraces in hilly and mountainous terrain can reduce erosion and sediment transport but also result in durable changes to the landscape.

The costs and benefits of SLM and land restoration greatly depend on where and how it is done. As the IPCC explains, measures that support land restoration practices include tenure reform, tax incentives, payments for ecosystem services, participatory integrated land-use planning, farmer networks, and rural advisory services.

While these measures are available, their adoption is generally limited to a minority of innovative land users and practitioners. Their implementation is restricted by economic, political, institutional, legal, and socio-cultural policy barriers. These barriers need to be addressed as a matter of urgency, including by:

No second chance: tipping points in mangrove ecosystems

Even with adequate implementation measures to avoid, reduce, and reverse land degradation, there are limits to adaptation, and some ecosystems may not recover. Mangroves are among the most productive marine ecosystems on the planet, providing habitats for many species as well as important ecosystem services for human well-being.

These highly productive forests produce rates of primary production equal to those of tropical humid evergreen forests. Mangrove habitat degradation, however, is increasing at an alarming rate, with global losses of 1% to 2% per year. This is due to climate change and human activities such as urban development and mining. These ecosystems play a unique role in human livelihoods through food, timber, fuel, and medicine, as well as being sources of protection from catastrophic events such as tsunamis.

© UNDP Brazil

It is also well documented that the degradation of mangroves can have important and widespread consequences for adjacent ecosystems. They risk passing the ecological "tipping point," leading to irreversible ecosystem loss. This is similar to the collapse of entire coral reefs through bleaching events. ■

- tackling environmental constraints such as climate, topography, or soil quality
- providing appropriate technologies, practices or equipment
- researching and exploring the most suitable options to study unknown ecological implications at different scales
- addressing institutional and governance issues that aggravate or inhibit decision-making at different scales
- scaling up available finance and access to capital

In developing integrated national climate and biodiversity strategies, countries should consider the tools and solutions most appropriate to their local context, and take the following into consideration:

Increase access to information, technologies and knowledge
Government plans should recognize and integrate local community needs, priorities, and expertise in the planning process, and integrate strong spatially explicit data on restoration potential. Stakeholder participation, which integrates indigenous and local knowledge and is gender-inclusive, should be included throughout the decision-making and implementation process.

Fill knowledge gaps
More research on co-benefits, trade-offs, barriers for implementation, and enabling conditions of different SLM technologies and practices in different contexts is needed. Decisions should consider species' functional traits to maximize the effectiveness of the restoration potential: planting drought-adapted or fire-resilient species in landscapes forecasted to become arid increases the ecosystems' resilience to hazards.

Develop resource-sharing practices and invest in capacity-building
Effective SLM practices in one area may not be the best option in another. Countries that share similar climatic challenges should prioritize knowledge-sharing to disseminate successful restoration strategies for climate change adaptation.

Develop effective, integrated services to support monitoring, evaluation and implementation
Moving away from sectoral policy design, implementing agricultural, land use, and water objectives coherently, and integrating them in climate and biodiversity strategies can support effective implementation. Policy coherence across scales is also critical.

Develop an appropriate policy-enabling environment
Appropriate incentives for landowners can enable and promote sustainable change.

Conclusion: integrated strategies and agendas

As Strassburg et al. (2020) point out, land preservation and restoration should be done with three criteria in mind:

- maximizing climate change mitigation
- biodiversity benefits
- the economic costs of inaction

This underscores the synergies that exist from linking the goals of the three UN Conventions (on climate change, combatting desertification, and biological diversity), as opposed to pursuing their targets in isolation. ■

Making land restoration a core part of climate strategies

As part of the Paris Agreement process, countries must provide new or updated climate strategies at regular intervals. Over 80 countries have updated their climate strategies ahead of COP26 in Glasgow in November 2021. Many have identified the land sector and land degradation as priority areas for action.

Papua New Guinea: transforming land degradation to restore ecosystems
Papua New Guinea (PNG) hosts unique forest ecosystems, which are crucial for carbon sequestration and biodiversity conservation. They also support indigenous livelihoods and underpin the timber market.

PNG reported significant greenhouse (GHG) emissions from the land use, land-use change and forestry (LULUCF) sector in its second nationally determined contribution (NDC) submission in 2020.

This spike in emissions is due to increases in deforestation and forest degradation caused largely by agricultural expansion and commercial logging.

The PNG government has taken steps to reverse the trend of land degradation and improve the management of protected areas. These include committing to an overarching target in the LULUCF sector to reduce GHG emissions caused by deforestation and forest degradation by 2030.

PNG's activities and actions to improve ecosystem restoration include:

- reducing annual deforestation and degradation by 25% against 2015 levels
- increasing afforestation, reforestation and ecosystem restoration
- improving protected area conservation and management
- promoting REDD+ (reducing emissions from deforestation and forest degradation) activities
- implementing its initiative to plant 10 million trees in PNG by 2030

UK: supporting nature's recovery and restoring land
The UK's 25-year environment plan was published in 2018 to address conservation, climate change, land use, sustainable global food supplies, and marine health. It sets out actions in land management, biodiversity, and nature recovery. Additionally, aspects of environmental policy are devolved, with each nation setting its own targets and policies:

England
In England, the Environment Bill 2020 proposes measures to restore and enhance nature. A new Environmental Land Management scheme is being developed to support nature's recovery and restore historical losses. The government plans to publish a new strategy for nature following agreement on global biodiversity targets.

Northern Ireland
In Northern Ireland, the Department of Agriculture, Environment and Rural Affairs engaged in a consultation to inform the development of a future environment strategy in February 2020. The Department intends to issue the draft strategy for public consultation in spring 2021.

Scotland
In Scotland, the Environment Strategy together with the Scottish Biodiversity Strategy will take account of the new post-2020 global biodiversity framework and targets to deliver improved and enduring benefits to the natural environment. The new Scottish Biodiversity Programme aims to coordinate activities, including the development of a future strategic framework for biodiversity in Scotland.

Wales
In Wales, the updated nature recovery action plan prioritizes the maintenance and improvement of resilient ecological networks and transformative change, including a new Sustainable Land Management scheme and work to improve the condition of protected sites and peatlands. ■

Ocean solutions

The continuous degradation of ocean health represents a major civilizational challenge and should be high on the international policy agenda. Ocean science and policy must offer sustainable solutions on climate, food supply, poverty reduction, and energy access

By Vladimir Ryabinin, Executive Secretary, Intergovernmental Oceanographic Commission of UNESCO

Our civilization is inflicting major damage on the ocean, the dominant feature and largest ecosystem of our planet. The decline in its health is undermining the ocean's crucial life-supporting functions for humanity. The consequences of human inability to live in harmony with nature and the ocean are accruing in three very closely connected and interacting domains: climate, biodiversity, and the economy. As customary, the worst scenario awaits the poor and underprivileged.

The compliance with and the rate of implementation of the UN Framework Convention on Climate Change (UNFCCC) Paris Agreement will shape future changes in ocean physics, dynamics, biogeochemistry, and biology. Already these are manifesting in warming, acidification, deoxygenation, sea-level rise, sea-ice melt, and so on. Increased severity of storms and alterations in patterns of long-term atmospheric variability are expected. The ability of the ocean to continue to

▲ Amatuku island in Tuvalu. Small island developing states like Tuvalu are exposed to the most extreme impacts of climate change, with their survival threatened by rising sea levels, ocean acidification, and extreme weather events

absorb carbon from the atmosphere may weaken, potentially requiring adjustment of climate scenarios. Expanding economic interests still prevail over the conservation considerations.

Practically all ocean ecosystems, especially coastal, are affected by unsustainable fishing, human activities, habitat destruction, and various facets of climate change. Multiple stressors are negatively impacting many marine species and disrupting natural food webs. Warm water corals that host one third of all marine species are practically doomed to bleach and die. This is the image of the sixth major period of species extinction in the last 450 million years occurring now. Growth scenarios of some key ocean-economy sectors (such as fisheries, aquaculture, and tourism) are strongly climate-change dependent.

Improving awareness

Since the adoption of the 2030 Agenda in 2015, several authoritative global assessments on the ocean have surfaced. In 2016, the UN published the first edition of the World Ocean Assessment and in 2021 released its second edition.

In 2019, the Intergovernmental Panel on Climate Change (IPCC) completed its Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) issued its Global Assessment Report. In 2019 to 2020, multiple experts associated with the High-Level Panel for a Sustainable Ocean Economy (HLP, comprising 14 heads of state or government) authored more than 20 reports on the status of the ocean and potential solutions.

In light of the aforementioned assessments, the existential issue of sustaining the ocean, previously believed to be a limitless resource, is starting to be mainstreamed in the international agenda. Notable is Sustainable Development Goal 14 (Life below water), with 10 useful targets. The Paris Agreement has just a single reference to the ocean in its preamble. However, after the presentation of SROCC to the UNFCCC, its Subsidiary Body for Scientific and Technological Advice has initiated an Ocean and Climate Dialogue. The Sendai Framework for Disaster Risk Reduction refers to coastal vulnerability. Various global and regional international conventions on ocean protection and fisheries are in action.

The UN is working on an international legally binding instrument (ILBI), under the United Nations Convention on the Law of the Sea, on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (BBNJ). The approach to ocean protection that, up until now, has been based more on goodwill should become both legally binding and based on science.

Awareness about the ocean as a common heritage of humankind is broadening and strengthening. The ubiquitous threat of plastic pollution is widely known. The Our Oceans conferences have been instrumental in attracting voluntary support for ocean protection. The UN Ocean Conference in 2017 saw previously unimaginable interest and inspired more than 1,600 voluntary commitments towards ocean sustainability. There are now high-profile individuals and multiple groups of influencers advocating for the ocean.

Since 1992, World Oceans Day has been celebrated annually on 8 June. There is great potential to proactively expand the awareness through “ocean literacy” activities. Lessons about the ocean should be systematically taught in schools, as part of the curriculum.

Delivering solutions

All sustainable solutions seeking to protect the planet’s largest ecosystem need to follow a two-pronged approach:

- continue mainstreaming the ocean in the international political agenda
- on a number of key issues, as detailed below

Overall, there is a need to urgently move towards integrated ocean management through coordinated and comprehensive planning based on sound science. The developments have been promising. The unprecedented scope and depth of the HLP analysis of ocean issues (health, economy, governance, and so on) resulted in the publicly announced commitment by the 14 countries to start sustainably managing 100% of the ocean area within their national jurisdiction by 2025. The HLP calls on other countries to follow suit by 2030.

The HLP analysis concluded that if the ocean is sustainably managed, it could generate six times more food than it does today through fisheries and aquaculture. It could also produce 40 times more renewable energy (mostly through wind turbines and solar batteries) and massively increase the scale of the ocean’s contribution to the world economy. The key conditions needed for this sustainable “sea change” include adequate planning based on data, links to national accounting, de-risking investments, and stopping pollution from entering the ocean from land.

These previously non-existent or not recognized possibilities call for significant strengthening of governmental support towards expansion of ocean management, namely:

- coastal zone management
- maritime spatial planning
- establishment of effective marine-protected areas
- development of real-time oceanographic services and early-warning systems

The prerequisite for success is reliance on capable science. The UN Decade of Ocean Science for Sustainable Development (2021 to 2030) is expected to:

- mainstream ocean science
- co-design and realize a new global ocean observation and data system
- offer a new level of certainty and transparency about the state of the ocean
- bring the capacity of all countries to the level needed to sustainably manage their exclusive economic

UNDP / Garth Cripps

▲ Semi-nomadic Vezo freedivers using traditional fishing techniques in Madagascar. Demand from external seafood markets is pushing fishing in the region to unsustainable levels

zones and the ocean beyond them, focusing on science for solutions

The Decade of Ocean Science aims to develop "the science we need for the ocean we want" (that is, a scientifically and sustainably managed ocean). With humankind living now in the geological epoch of the "Anthropocene," only this approach can stop the "suicidal war on nature," in the words of UN Secretary-General António Guterres.

In addition to the systematic approach outlined above, we must meet a number of milestones on the way to achieving the ocean we need for the future we want. These are:

- bringing the issues of climate change impact on the ocean and ocean-based climate solutions to the core UNFCCC debate
- satisfactory conclusion of negotiations at the World Trade Organization on stopping harmful state subsidies for large-scale fisheries
- completion of the BBNJ ILBI and developing an implementation plan for the instrument
- establishing by 2030, on the basis of science, well-chosen and effective marine protected areas covering 30% of the ocean area
- implementing science-based, transparent, and fair fishery and sea food management, with effective port state control and end-to-end food origin tracing
- eliminating food wastage and better using food resources from fisheries and aquaculture to combat hunger and malnutrition, support human health, and reduce environmental impact from agriculture
- increasing investment in ocean-based renewable energy, turning it into a significant share of the global energy supply
- establishing measures that strengthen the resilience and insurability of coastal zones, building on ocean-borne risk assessment and build-up of early-warning systems for storms, tsunamis, floods, harmful algal blooms, and so on
- equitable inclusion of local coastal populations in sustainable coastal and ocean planning and related economic development

Humankind has tested the limits of the ocean's ability to support life. On multiple fronts, ocean ecosystems are approaching tipping points. The causes and consequences of these threats are known, but capabilities to remedy the situation exist.

Even more than that, the ocean can function as an amplifier whose sustainable management can help solve the major challenges that humankind faces and be an ally in climate action and delivering the SDGs.

Action on the ocean should be at the core of international efforts to build forward better. But most of the action toward managing the ocean sustainably should occur at a national level, embracing not only leaders, but many other categories of stakeholders. In return, a healthy ocean will share its health with people. ■

Save our species

Without action, this century will see many more species go extinct. Halting biodiversity loss calls for all countries to act now to transform how we produce, consume, and manage resources

By Aline Mosnier, Scientific Director, FABLE (Food, Agriculture, Biodiversity, Land-use, and Energy) Pathways Consortium, SDSN; Sarah K. Jones, Associate Scientist, Bioversity International; and Andrea C. Sánchez, Research Fellow, Bioversity International

The sixth mass extinction is underway and biodiversity decline has picked up across many indicators. Species extinction rates are accelerating rapidly at a global scale. Around one million animal and plant species are threatened with extinction, constituting over a quarter of the world's species. Projections estimate that doing nothing to reverse biodiversity loss will increase the number of extinct species globally by 4% (range 1% to 12%) by 2100.

These threats extend to the biodiversity that supports our food and agriculture systems. Globally, production systems and markets have become increasingly homogenized. There are at least 12,000 edible plant species (probably nearer 60,000), yet just nine of them account for 66% of global crop production. However, many edible plant species or their wild relatives are at risk of extinction. The use of local livestock breeds in production is declining, with 26% of breeds threatened with extinction, while 33% of fish stocks are overfished.

◂ The northern edge of the Aral Sea in Kazakhstan after restoration. The sea was formerly an extreme symbol of environmental destruction, reduced to salty desert. This section has been restored with freshwater, teams with bird-life, and provides food and livelihoods to the local community through its increasingly diverse fish stock

land and intensifying crop and livestock farming practices are the major culprits of biodiversity annihilation. Freshwater and marine ecosystems are being polluted by sediment and chemical run-off from agriculture. Marine biodiversity is jeopardized by fishing and aquatic ecosystem degradation. Freshwater biodiversity is declining in every major river basin, while deep-sea fishing is emptying large swaths of the ocean

// Unsustainable consumption and overpopulation are important indirect drivers of biodiversity loss

Insects that support agricultural production are also at risk, with pollinator declines now being reported across the globe.

Biodiversity and the SDGs

Safeguarding biodiversity is linked to achieving many of the Sustainable Development Goals (SDGs), as biodiversity depends to various extents on land use and maintaining healthy, balanced ecosystems. There are large synergies between climate change mitigation (SDG 13) and biodiversity protection (SDGs 14 and 15). Tropical forests, for instance, store one third of the world's land carbon and harbor more than two thirds of the world's land-based species. Ensuring sustainable water management (SDG 6), both in terms of quality and availability, is crucial for the survival of many species. The reintroduction of some key species might lead to positive effects on stream hydrology.

There are also multiple links between biodiversity and achieving food and nutrition security (SDGs 2 and 3).

Biodiversity in peril

Global biodiversity is directly threatened by five main anthropogenic drivers:

- the conversion of terrestrial and aquatic natural ecosystems to other uses
- the overexploitation of organisms
- direct and indirect effects of climate change
- alteration and pollution of natural habitats
- invasion of alien species

As natural habitats change and disappear, biological populations change and decrease with them. Replacing wild habitats with agricultural of nearly all life, disrupting coral reefs and causing extinctions and population declines at all latitudes. The trade in wildlife flora and fauna and their products is also a huge threat to many endangered species.

Unsustainable consumption and overpopulation are important indirect drivers of biodiversity loss. We can produce enough food to feed 10 billion or more people with nutritious diets, with no agricultural land expansion and without exceeding global climate change boundaries.

Yet achieving this will require drastic changes in diet for most people. Providing the world's eight billion people with the diets and living standards of those living in the USA, for example, would require double the planet's resources in terms of energy consumption. While improved standards of living lead to

smaller average family sizes, they also create increased per capita resource consumption. At current population levels, we would need five times the planet's resources to ensure no one lives in poverty without compromising people's freedom to choose how many children they have.

Poorly targeted, weakly enforced and insufficient coverage of protected areas hamper efforts to safeguard biodiversity. Yet conservation measures such as creating protected areas are a critical strategy for halting biodiversity loss, if implemented effectively.

Currently, the world's protected areas cover nearly 16% of terrestrial and freshwater environments and 8% of marine areas, but they do not fully protect areas of importance for biodiversity conservation, and they are not all effectively or equitably managed.

We need systemic change

Halting biodiversity loss requires systemic change. Removing the direct and indirect drivers of biodiversity loss calls for a transformation of the way we produce, consume, and manage resources at all levels.

We must move towards a circular economy underpinned by sustainable food and land use systems. Policy investments and incentives, technical innovations, responsible marketing, education at all levels, and alternative business models all have a role to play. Together, they must stimulate societal and cultural behavior changes towards minimum pollution and waste, and reasonable per capita consumption.

As acknowledged by SDG 12, consumers play a key role in adopting lifestyles that are in harmony with nature. However, consumers need to be informed about their current ecological footprint. Greener alternatives should be both attractive and accessible. Studies have highlighted that global population growth may peak soon after mid-century if living standards for women continue to improve. To achieve decent living standards for all by 2050 while reducing pressure on biodiversity, we must combine education with game-changing policies and business models that support sustainable consumption.

Life on land

Preserving biodiversity on land will require actions on many fronts. We must restore wilderness areas, significantly improve the ecological functioning of managed land, and improve and expand the conservation of biodiversity in protected areas. Allowing large predators to reinhabit lost territories, through active reintroductions and creating habitat corridors to facilitate migration, would help restore faunal integrity and recover population numbers.

> *Allowing large predators to reinhabit lost territories, through active reintroductions and creating habitat corridors to facilitate migration, would help restore faunal integrity and recover population numbers*

On agricultural land, we need to restore ecological functioning, for example through agroforestry, use of cover crops, no or reduced agrochemical inputs, and reduced tillage. We must combine these efforts with actions to provide fair incomes, opportunities, and living standards for agricultural workers.

Finally, successful land conservation outcomes will depend on:

- governance
- local engagement, including respecting and protecting indigenous people's rights and stewardship roles
- effective and equitable benefit-sharing mechanisms
- sustainable funding
- effective monitoring and enforcement systems of protected areas

Life in water

Halting and reversing loss of marine life would be greatly supported by abolishing subsidies for unprofitable large-scale commercial fishing fleets. It would also be helped by introducing and enforcing, through independent observers and spot checks, strict equipment restrictions that reduce by-catch and damage to non-target species or coral reefs.

The regulation and expansion of well-designed marine protected areas, especially in habitats used by megafauna and migratory species, can also contribute to the conservation of biodiversity and sustainability of food provision. These measures are unlikely to result in the complete recovery of fish stocks, but give us a chance of not losing the aquatic biodiversity that remains.

Conclusion

More than ever before, human activities are the direct and indirect drivers of biodiversity loss. The negative effects of species extinction and ecosystem degradation on the vital services that ecosystems provide are likely to increase in the next few years.

Current national biodiversity strategies struggle to address major drivers of biodiversity loss. Countries must take immediate action to improve biodiversity conservation and transition to sustainable production and consumption patterns. Through this, they can help restore biodiversity while achieving healthy diets and a good standard of living for all people by 2050.

As we approach the climate and biodiversity COPs and UN Food Systems Summit, countries should now seek to develop integrated long-term strategies to ensure coherence across the biodiversity, food, climate, water, and energy sectors. ■

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Front cover: Members of the indigenous communities in Cauca, Colombia, collect face masks and food during the COVID-19 pandemic. © UNDP Colombia / Oscar Bermeo

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SDG ACTION

SDG Action is a new initiative launched by the UN Sustainable Development Solutions Network (SDSN) to support the UN's Decade of Action.

A resource for sustainability practitioners in all sectors, it brings timely analysis of the most pressing challenges. Its emphasis is on identifying opportunities and providing tangible ways to accelerate progress. The website features articles from world-leading experts on all aspects of the Sustainable Development Goals (SDGs) and climate action.

Two print editions are released annually, to coincide with major global diplomacy events. These editions provide a framework to understand the complex interdependencies between the SDGs, highlight priorities and dilemmas, and suggest ways to make the greatest impact, fast.

Please contact us at info@sdg-action.org if you would like to share feedback and ideas or would like to be involved.

About SDSN

The UN Sustainable Development Solutions Network (SDSN) was set up in 2012 under the auspices of the UN Secretary-General. SDSN mobilizes global scientific and technological expertise to promote practical solutions for sustainable development, including the implementation of the SDGs and the Paris Agreement.

SDSN works closely with United Nations agencies, multilateral financing institutions, the private sector, and civil society.

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