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SCIENCE20 – G20 SCIENCE ACADEMIES SUMMIT

Transformative Science for Sustainable Development

COMMUNIQUE

Coimbatore, Tamil Nadu
21-22 July, 2023

Science20 – G20 Science Academies Summit
Coimbatore, Tamil Nadu

Communique

We, the Science Academies of the G20 member states and invitee countries, met in Coimbatore, India, on July 21-22, 2023, to recognize the need for transformative science for sustainable development in the spirit of Vasudhaiva Kutumbakam (One Earth, One Family, One Future).

Science20 (S20) meetings, hosted by India during its G20 Presidency, were held under the theme "Transformative Science for Sustainable Development" and provided a platform for science academies to deliberate their sub-themes. These were: 'Clean Energy for Greener Future', 'Universal and Holistic Health', and 'Connecting Science with Society & Culture'. Our detailed recommendations are as follows:

A. Clean Energy for Greener Future

Background

1. Energy underpins and is essential to human and economic development. However, today's dominant energy systems are contributing to climate change and other adverse environmental and health impacts. The Intergovernmental Panel on Climate Change (IPCC) which represents the best available science noted in 2019 that energy, transport, and industry sectors contributed to 72% of the total direct emissions of 59 Gigatons of Carbon Dioxide ($GtCO_2$).[1] Clean and affordable energy, adopted by the United Nations (UN) as the Sustainable Development Goal (SDG) 7 is essential for a sustainable future for humanity and, therefore, needs urgent attention.
2. During the last decade, significant advances in innovation and deployment have led to reductions in the cost of low-carbon/emission technologies such as solar photovoltaic (PV) and wind. This opens up many opportunities for decarbonization[2] at scale. At the same time, several challenges remain – utility scale storage solutions and decarbonization of heavy industry and transport remain expensive or are yet to be deployed at scale. Given the urgency of the climate challenge, the pace of this clean energy transition needs to be greatly accelerated. This is due to the role of the energy sector as a major greenhouse

[1] IPCC. 2022. Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK: Cambridge University Press.
[2] Decarbonization refers to "Human actions to reduce carbon dioxide emissions from human activities." Ref: www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Annex-I.pdf

gas (GHG) contributor and the broad consensus on the need to achieve global net-zero GHG emissions by or around mid-century.

3. Equity considerations have increasingly become central to the discourse and must now play a key role in the energy transition. At the global level, countries have contributed to cumulative GHG emissions to different degrees and are at different levels of development, capability, and vulnerability. Similarly, the question of justice arises at sub-national levels too, as massive systemic transitions are highly likely to have significant distributional implications on economic and employment structures.[3] Such issues, and exploration of ways to address them, have gained more traction recently.
4. These issues need to be addressed not only for ethical reasons but also practical reasons, since not engaging adequately with these issues may well impede the clean energy transition.
5. One of the outcomes has been an increasing focus on "Just Transitions", which, in the broadest sense, aim to leave no one behind.[4] While much of the attention is on those who will be disadvantaged by the transition (such as workers, communities, and nations that depend on fossil fuels), if it is to be truly inclusive, we need to also focus on those who lack access to clean energy.
6. According to the International Energy Agency, there were about 775 million people worldwide who didn't have access to electricity and about 2.5 billion people who didn't have access to clean cooking facilities in 2022.[5] It is not just the scale of this problem that is surprising but also its persistence. Lack of access to clean energy greatly impedes human development, with women and children being affected particularly. For example, household air pollution, mostly from smoke resulting from combustion of biomass, kerosene or coal, is linked to around 3.2 million premature deaths a year.[6] Therefore, clean energy access is an issue that needs to be addressed as an integral part of a green energy transition.
7. The G20 member states account for more than 75% of global energy consumption and more than 75% of CO2 emissions.[7] They also are responsible for a large fraction of clean-energy innovation globally. Therefore, enhanced coordination and collaboration between G20 member states will be the key to shaping the transition of global energy systems towards sustainable, inclusive, green, and just outcomes.

[3] *ibid.*
[4] UN DESA Policy Brief No. 141: A just green transition: Concepts and practice so far | Department of Economic and Social Affairs - United Nations. Available at: https://www.un.org/development/desa/dpad/publication/un-desa-policy-brief-no-141-a-just-green-transition-concepts-and-practice-so-far
[5] IEA SDG7: Data and projections – analysis, IEA. Available at: https://www.iea.org/reports/sdg7-data-and-projections/
[6] Household Air Pollution - World Health Organization. Available at: https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health
[7] Ritchie, Hannah, Max Roser, and Pablo Rosado. 2022. "Energy." Our World in Data. https://ourworldindata.org/energy

Way Forward

8. The Science20 Academies urge the G20 member states to further strengthen their collaboration to accelerate the clean energy transition in line with the long-term temperature goal of the Paris Agreement (including use of market-based approaches) while also advancing a sustainable, inclusive, green, and just transition, focusing:

a) Enhancing innovation in all its stages through cooperation, collaboration, and partnership.

i. For technologies requiring further development or those that are in the pre-commercial stage, the G20 member states should aim to strengthen cooperation. This can happen through joint R&D projects, shared sponsorship of long-term innovation programs, and developing policy regimes incentivizing investment in clean energy research and development. The G20 member states should also promote collaborative efforts to support and strengthen the clean-energy-startup ecosystem. This effort should link to, and find synergy with, other relevant G20 tracks. For mature and commercially competitive technologies, the G20 member states should cooperate to accelerate deployment through pilot projects, sharing of effective practices on policy designs for specific technologies, and encouraging financial and technology flows.

ii. Areas such as grid integration of renewable electricity, hydrogen produced from zero and low emission technologies and its derivatives (such as ammonia, biofuels, e-fuels), and energy storage may be key to the clean energy transition and therefore require specific attention.

iii. Accordingly, we recommend that the G20 member states enhance their collaboration in these areas by increasing joint R&D efforts, coordinating on early deployment, and sharing effective practices on scale-up and deployment pathways. Greater engagement of industry in such activities is fundamental.

iv. The G20 member states are urged to strengthen their focus on demand-side reductions through research and development, and demonstration. This would include engagement of physical sciences and other disciplines such as behavioral sciences, economics, sociology, geography, psychology, architecture, and cultural studies. Such an effort could yield significant benefits across the G20 and other countries.

b) Enhancing clean-energy access by utilizing advances in clean-energy technologies

i. The Science20 Academies recommend that the G20 member states take actions to enhance clean energy access. This could be done by leveraging the performance gains and cost reductions in clean-energy technologies, especially renewable energy and energy storage.

ii. A multi-faceted approach is required, including the promotion of renewable energy technologies, capacity building, and appropriate policies. By partnering with local governments, NGOs, and private sector entities, the member states can facilitate the implementation of clean energy projects, such as solar and wind power systems, mini-grids, and energy-efficient solutions. The outcomes of these efforts will potentially be far reaching, improving livelihoods, empowering communities, reducing GHG emissions, and fostering economic development while advancing the global transition to a clean and inclusive energy future.

B. Universal and Holistic Health

Background

1. Increasing the healthy life expectancy for all while promoting well-being across the whole life course are key objectives of the United Nations Sustainable Development Goals (SDGs), in particular, SDG 3. Economic and social development at the national and global levels is dependent on good health. Therefore, universality is a major consideration because of basic notions of justice and the importance of health at individual and population levels for broader development.
2. Health has both intrinsic and instrumental (e.g., economic) value. There also is an improved understanding of the role of holistic approaches for maintaining good health. A broad perspective on health also requires consideration of the natural and social environment. This is illustrated by the "One Health" approach advanced by World Health Organization (WHO) and other United Nations (UN) agencies[8] that highlights the interconnections of the health of humans and other animals, plants, and ecosystems.
3. Universal and holistic health requires the integration of knowledge and insights from science and emphasizes the role of a range of disciplines, analytical tools, and technologies. These include, but are not limited to, biology, medicine, "omics" approaches, data science and artificial intelligence (AI) and machine learning (ML), digitalization, psychology, ecology, public and occupational health, social sciences, and the humanities.
4. A holistic approach is useful, not just for science, but also for practice and policy. Such an approach requires a holistic view of all stakeholders: scientists, medical doctors, healthcare professionals and health workers, affected families and individuals, policymakers, and others.
5. Understanding the physiology of health and disease across diverse geographic and cultural contexts is important. In this context, understanding gene-environment interactions (GEI) requires studies of the meta-genome, biomarkers, and their interaction with other factors across population groups around the globe.

[8] One Health High-Level Expert Panel (OHHLEP) 2022: One Health Theory of Change https://cdn.who.int/media/docs/default-source/one-health/ohhlep/ohhlep--one-health-theory-of-chance.pdf; One Health High-Level Expert Panel (OHHLEP) 2022. One Health: A new definition for a sustainable and healthy future. *PLoS Pathog* 18(6): e1010537. https://doi.org/10.1371/journal.ppat.1010537

6. There is a need for a holistic approach to addressing health. This includes prevention (e.g., cleaner environments, nutrition, education) and treatment.

Way Forward

7. The Science20 Academies recommend that the G20 member states strengthen collaborations in a number of key areas:

a) Strengthening surveillance and prediction systems that monitor wildlife, veterinary populations, and human communities. This will enable early detection and the prediction of emerging and re-emerging pathogens with pandemic potential.

b) Undertaking joint actions to tackle antimicrobial resistance (AMR), (e.g., preventing the misuse of antibiotics in human and veterinary practice as these result in contamination of water and soil through pharmaceutical effluents and agricultural usage) as well as zoonotic spillovers.

c) Development of non-resistance-forming drugs and novel antibiotics for AMR. This involves new drug-discovery approaches such as those based on artificial intelligence (AI), machine learning (ML)[9] and federated machine learning. Equally important are strong supply chains and mechanisms for equitable access.

d) Using data science, especially AI and ML, to integrate multi-disciplinary knowledge that can help identify causal pathways of disease (biological, social, and environmental determinants of health across the whole human family and ecosystems), and develop predictive, diagnostic, and management algorithms.

e) Expanding joint efforts on mental health with an emphasis on community-centred, primary healthcare-led, and telehealth-supported services. This will allow for early detection, continuous and equitable access to healthcare professionals, as well as provision for adequate support and treatment. In addition, practices such as physical exercise, yoga, and meditation can be integrated.

f) Developing a better understanding of economics and market dynamics of healthcare products and services in addition to resilience of health systems to advance the availability of affordable, accessible, and sustainable healthcare services for all.

g) Deepening collaboration on traditional medicine and knowledge, exploring evidence-based use of these systems and how they may complement existing approaches for modern preventive and curative approaches. This includes scientific research for mechanistic understanding and standardization of knowledge from different systems of traditional medicine and integration of beneficial practices, informed by evidence, for complementary use in healthcare.[10]

[9] See, for example: Liu, G. et al. (2023) Deep learning-guided discovery of an antibiotic targeting Acinetobacter baumannii, Nature News. Available at: https://www.nature.com/articles/s41589-023-01349-8

[10] A prominent example is the development of artemisinin and the resulting effective treatment for malaria that drew upon traditional knowledge (https://www.nobelprize.org/prizes/medicine/2015/tu/facts)

h) Given the importance of authentic health information to all for achieving universal health, the G20 member states should share experiences and best practices in the effective dissemination of such information to diverse populations.

i) Emphasizing the importance of education and training in health care, including capacity building of health professionals and other stakeholders. This will ensure programs are adapted to local socioeconomic and cultural environments while preserving a scientific evidence-based approach.

C. Connecting Science with Society & Culture

Background

1. The pursuit of knowledge has long been a fundamental aspiration of humanity and the resulting understanding of the natural and social worlds has underpinned human progress and development. Recent breakthroughs in science and technology are transforming our philosophical and cultural perceptions, social contexts, and lives.[11]
2. Science and discovery are products of individuals or groups from natural sciences, humanities, and social sciences. Together, they address societal challenges. At the same time, the scientific enterprise and its priorities are shaped by social and cultural contexts.
3. Rapid advances in science and the translation of the resulting knowledge into technologies and practices have had a widespread impact, which continually changes the relationship between science and society. A better understanding of this relationship provides opportunities to improve human welfare while also anticipating and mitigating, as much as possible, the undesirable or unintended consequences of these scientific and technological advances. Recent advances in artificial intelligence (AI) and machine learning (ML) are illustrative of this dual nature: there is much excitement and enthusiasm about the enormous possibilities for contributing positively to domains as diverse as science, health, energy, agriculture, and education. At the same time, there are concerns about the potentially harmful implications for livelihoods, information, social order, and governance.
4. The continuous, and in many ways accelerating, the evolution of society and culture driven by scientific and technological advancement may contribute to the unintended erosion of our heritage and diversity. Languages are being lost, as are many cultural practices and traditional arts. However, modern science and technology also offer us an unparalleled opportunity to preserve our history and heritage and make it much more widely and equitably accessible.

[11] For example, work on mRNA allowed the development of the COVID-19 vaccine in record time.

5. There is an intricate relationship between ecological and cultural diversity. They are not only mutually reinforcing but also important ingredients of sustainable development. Cultural diversity, with its rich traditional knowledge and practices, often holds important insights for sustainable resource management and adaptation to environmental changes. Preserving such diversity, a desirable goal in and of itself also offers other benefits.
6. Connecting science to society and culture goes beyond the dissemination of scientific information. It involves the development of rational and evidence-based thinking and informed public opinion, building bridges that may facilitate dialogue, mutual understanding, and co-creation between scientific communities and diverse societal stakeholders. By promoting science communication, citizen science initiatives, and participatory research, the scientific enterprise can empower individuals and communities to actively engage with scientific discoveries, complement research efforts, and contribute to the decision-making processes that influence the development and deployment of transformative innovations. At the same time, other stakeholders (industry leaders, policymakers, civil society actors, and, indeed, citizens, and others) take the initiative and share responsibility of engaging with the scientific enterprise and the knowledge that it generates.

Way Forward

7. The Science20 Academies recommend that the G20 member states enhance the positive linkages between science, society, and culture through two specific sets of collaborative actions.

a) Develop and promote a platform for digital technologies for the protection, preservation, and reproduction of heritage by strategically planning a set of activities[12], including:

i. Better leveraging science and technology to digitally document and preserve heritage across the globe, including historical sites and artefacts. This could include the development of robust tools to verify and authenticate data backed by the relevant metadata.
ii. Supporting systematic analyses of data, including historical records, archaeological findings, and other artefacts, to enable researchers to gain new perspectives on cultural practices, traditions, and historical events.
iii. Enhancing immersive learning at local levels to facilitate the bridging of the digital divide and hands-on activities in the field of culture and science, in

[12] There should also be an opportunity to synergize with the existing Saudi Arabia and UNESCO initiative "Dive into Heritage".

particular, amongst students and teachers. This would also contribute to broader capacity building and awareness raising.

iv. Preserving digital heritage through a better understanding of how new media and cultural artefacts produced today can be preserved for generations to come, including systematic thinking on these efforts to ensure that the digital material travels well into the future.

v. Developing legislation for impact assessment prior to infrastructure development in order to salvage archaeological artefacts, promote conservation, and increase the number of virtual museums. This will increase job opportunities through expansion in cultural resource management.

b) Strengthen International Cooperation on Emerging Technologies by:

i. Developing a broad-based venue, platform, or organization to bring together experts from governments, international organizations, academia, and civil society from across the G20. The objective is to provide inputs to guidelines for responsible, just, equitable, safe, and sustainable use of emerging technologies (for example, generative AI, gene editing for inheritable traits, and solar geoengineering). While there are some existing efforts in this domain, they are mostly national or regional. It is critical to get a broader engagement on these topics because the potential benefits and concerns relating to emerging technologies may vary across national contexts and interests, even when the impacts transcend national boundaries.

ii. Promoting diversity and inclusion to create the conditions for creative and responsible innovations to be prioritized and supported. This would require the expansion of education to ensure well-informed stakeholders at all levels.

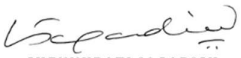
Endorsing Academies[i]

Academia Nacional de Ciencias Exactas, Físicas y Naturales

VICTOR A. RAMOS

President, Academia Nacional de Ciencias Exactas, Físicas y Naturales

Australian Academy of Science



CHENNUPATI JAGADISH

President, Australian Academy of Science

ACADEMIA BRASILEIRA DE CIÊNCIAS

HELENA B. NADER

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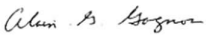


ALAIN-G. GAGNON

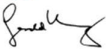
President, The Royal Society of Canada

中國科學院 CHINESE ACADEMY OF SCIENCES

JIANGUO HOU

President, Chinese Academy of Sciences

Leopoldina Nationale Akademie der Wissenschaften



GERALD H. HAUG

President, Leopoldina – Nationale Akademie der Wissenschaften

ASHUTOSH SHARMA

President, Indian National Science Academy

BRIN

BOEDIASTOETI ONTOWIRJO

Deputy Chairman for Research and Innovation Policy, National Research and Innovation Agency of the Republic of Indonesia

TAKAAKI KAJITA

President, Science Council of Japan

KAST 한국과학기술한림원 The Korean Academy of Science and Technology

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President, The Royal Society

NATIONAL ACADEMY OF SCIENCES

MARCIA MCNUTT

President, National Academy of Sciences

[i] The S20 meeting was held in-person format. France and Italy could not participate in-person.