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## Multi-stakeholder forum on science, technology and innovation for the Sustainable Development Goals

### Note by the Secretariat

The President of the Economic and Social Council has the honour to transmit to the high-level political forum on sustainable development the Co-Chairs' summary of the multi-stakeholder forum on science, technology and innovation for the Sustainable Development Goals, held virtually on 4 and 5 May 2021, with an additional day of side events on 3 May. The Co-Chairs of the forum, the Permanent Representative of Latvia to the United Nations, Andrejs Pildegovičs, and the Deputy Permanent Representative and chargé d'affaires a.i. of the Permanent Mission of Indonesia to the United Nations, Mohammad Koba, were appointed by the President of the Council. The summary is being circulated pursuant to paragraph 123 of the Addis Ababa Action Agenda (General Assembly resolution 69/313) and paragraph 70 of the 2030 Agenda for Sustainable Development (Assembly resolution 70/1).

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# Co-Chairs' summary of the multi-stakeholder forum on science, technology and innovation for the Sustainable Development Goals

## I. Introduction

1. The present summary represents a reflection of the broad discussions that took place during the multi-stakeholder forum on science, technology and innovation for the Sustainable Development Goals. The summary brings together a diverse set of views articulated through both formal and informal statements provided by stakeholders. The views presented do not necessarily represent opinions held or endorsed by the Co-Chairs or the governments that they represent.

2. Pursuant to General Assembly resolution 70/1, on 4 and 5 May 2021, the President of the Economic and Social Council, Munir Akram, convened the sixth annual science, technology and innovation forum. As a component of the Technology Facilitation Mechanism, the forum is a venue to discuss cooperation in science, technology and innovation around thematic areas pertaining to the implementation of the Sustainable Development Goals, bringing together all relevant stakeholders to actively contribute in their areas of expertise. The forum provides a venue for facilitating interaction, matchmaking and the establishment of networks and multi-stakeholder partnerships, in order to identify and examine needs and gaps in terms of technology solutions, scientific cooperation, innovation and capacity-building; to examine the impact of rapid technological change on the Sustainable Development Goals in the light of the coronavirus disease (COVID-19); and to help to facilitate the development, transfer and dissemination of relevant technologies for the Goals and targets.

3. The Permanent Representative of Latvia to the United Nations, Andrejs Pildegovičs, and the Deputy Permanent Representative and chargé d'affaires a.i. of the Permanent Mission of Indonesia to the United Nations, Mohammad Koba, co-chaired the forum. The forum was prepared by the United Nations inter-agency task team on science, technology and innovation for the Sustainable Development Goals, with the support of the 10-member group of high-level representatives from civil society, the private sector and the scientific community in support of the Technology Facilitation Mechanism.

4. The opening of the forum featured statements by the President of the Economic and Social Council, Munir Akram, the President of the General Assembly, Volkan Bozkir, and the Secretary-General (remarks delivered by the office-in-charge of the Office of the Secretary-General's Envoy on Technology, Maria-Francesca Spatolisano).

5. Two keynote speakers set the scene for the forum: Julie Makani, Professor and Principal Investigator, Muhimbili University of Health and Allied Sciences, United Republic of Tanzania; and Rajiv Shah, President of the Rockefeller Foundation.

6. The forum was held in a fully virtual format, in view of the continuing COVID-19 pandemic. The forum was well attended and included representation from governments, scientists, innovators, technology specialists, entrepreneurs and civil society. Many more also followed the forum live on UN WebTV and other platforms, and the recordings continue to be viewed. Cumulative viewership, at the present rate, will be in the thousands. The forum comprised interactive sessions that engaged all stakeholders in the deliberations. Active civil society participation was strong, with 570 registrations for interactive participation and 109 speaking requests. In line with its mandate, the forum promoted networking, a virtual innovation exhibit and special events on reflections by members of the 10-member group; on science, technology and innovation and harnessing global opportunities for transformation in 2021; on digital

cooperation; and on promoting inclusion to accelerate innovation. A total of 33 side events also took place. The forum included ministerial sessions, which featured 24 live statements on science, technology and innovation policies and initiatives from ministers and other high-level speakers and an additional seven written statements.

# II. Highlights of discussions at the science, technology and innovation forum

7. The forum deliberated on lessons from the COVID-19 pandemic in terms of a better science-policy-society interface, a resilient recovery and rapid solutions for global challenges. It identified top priorities for research and development and science, technology and innovation solutions for "building back better" and accelerating progress towards the Sustainable Development Goals, with an emphasis on Goals 1, 2, 3, 8, 10, 12, 13, 16 and 17, which are the in-focus Goals under review at the high-level political forum to be held in 2021. The forum examined the promise and potential risks of emerging science and technologies and discussed technological and capacity divides. It linked directly to the inter-agency task team work streams on science, technology and innovation road maps for the Goals, emerging science and technologies, capacity-building, gender and the Technology Facilitation Mechanism online platform. It concluded with a discussion of opportunities and the way forward for the Technology Facilitation Mechanism and associated global and regional initiatives of a multi-stakeholder nature. Good practices and policy recommendations as well as challenges were identified with a view to facilitating the development and scaling up for adoption and dissemination of relevant technologies for sustainable development. The 10-member group appointed by the Secretary-General moderated most of the sessions and provided their vision for the Technology Facilitation Mechanism.

8. Selected messages and highlights of the forum are presented in the remainder of the present summary. Statements and presentations in the opening session laid out "big picture" views of key issues, principles and policy responses, many of which were further elaborated upon in later sessions.

## A. Science, technology and innovation lessons from the COVID-19 pandemic

9. The forum explored lessons from the COVID-19 pandemic for a better science-policy-society interface, a resilient, sustainable and inclusive recovery and rapid solutions for global challenges. That included reflections on the response of the scientific community to the pandemic, its impact on open science, building trust in science, support for the socioeconomic recovery, including the role of the creative economy sector, advancement of gender equality, and lessons learned on how to better harness science and technology to resolve global challenges.

10. Science, technology and innovation have enabled the world to soften the impact of the COVID-19 pandemic at the individual, social and economic levels, compared to what would have happened if the pandemic had occurred 30 years ago, with no teleworking, no videoconferencing, no telemedicine, no remote learning and limited means of communicating with loved ones. On the other hand, even today, 3 billion people remain unconnected, and many more have not been able to shift vital activities online.

11. To fight COVID-19, it has been essential to bring together scientific knowledge and data and to share it freely across national and disciplinary boundaries and between the public and private sectors, all of which has greatly accelerated research and innovation on drugs, vaccines and digital applications. However, existing capabilities have had to be developed over decades, primarily through public research and

development funding. One of the lessons has been that efforts to achieve sustainable resilience warrant tapping into a wide range of knowledge and capacities.

12. The pandemic is ongoing, and lessons continue to be learned. It is an example of a complex societal problem for which an effective science-policy interface is essential. Although research has been greatly sped up, it continues to be relatively slow compared to the speed with which the political world is required to act. This presents important lessons for the science-policy interface and for addressing other "wicked problems", such as climate change.

13. However, in many ways the global innovation system did deliver. In 2020, 75,000 scientific articles were published on COVID-19, more than 70 per cent of which were open access – much more than in other sectors. Billions of dollars have been spent on virus research and for the development of vaccines and treatments, with unprecedented levels of international scientific cooperation. Barely a year after the World Health Organization (WHO) declared the pandemic, several highly effective vaccines had become available, and 1.01 billion vaccine doses had already been administered as at 24 April 2021.[1] At the same time, vaccine distribution and uptake has been deeply unequal across countries. The pandemic is a stress test for our science, technology and health systems and has revealed areas that require strengthening to improve preparedness for crises.

14. Strengthening of universal health-care systems is essential for resilience and preparedness. Extreme inequalities in terms of knowledge, innovation and production capabilities render public health responses ineffective. Global efforts are needed to guide economic and technological capabilities towards public health and other Sustainable Development Goal aspirations.

15. COVID-19 is imposing a new type of economy, one which is based on science, technology and innovation and new forms of social organization. It is thus more important than ever to spread science, technology and innovation knowledge everywhere, so that it can create prosperity and benefits for everyone, rather than creating new forms of exclusion.

16. Governments and stakeholders across the world have supported a wide range of technological applications and innovations that underpin the new economy. Examples include decentralized production and delivery systems; automated services; big data for management and decision-making, preventive maintenance and digital marketing; and data safety and security innovations. Reliance on many new Internet-based applications also requires a more effective, transparent and trustworthy system of governing the Internet.

17. Scientific literacy is essential for our responses to the pandemic. However, scientific communities take a long time to build and require sustained investments. The pandemic has exposed gaps in scientific capacity infrastructure in many parts of the world, making citizens more vulnerable to the crisis. In the face of competing priorities, developing countries can build more effective science systems through international scientific cooperation and international research centres.

18. The pandemic did not come out of the blue – there had been many warnings. In fact, changes in ecology, the environment, urbanization, trade, travel, neglect of public health and limitations in international cooperation created a perfect storm that has made these kinds of pandemics more likely to happen. There are similar warnings on other sustainability events that are transnational by nature and require international cooperation to ensure that science informs policy and good policy decisions are made on the basis of evidence.

[1] https://ourworldindata.org/covid-vaccinations (accessed 24 April 2021).

19. There is a risk we will give digital transformation a bad name in the coming years if we do not ensure we distribute the benefits of the digital transformation. Similarly, following the global financial crisis a decade ago, opposition to globalization grew, since its benefits were not shared adequately. The result was sociopolitical impacts that persist to this day. The pandemic has already increased socioeconomic inequalities worldwide and has set back development by many years in some countries. Access to resources for science, technology and innovation has been extremely unequal.

20. Member States should heed calls for a shift in research priorities to address truly global public good problems, and for a review of their policies and research and development funding. In particular, international collaboration mechanisms require strengthening and adequate funding.

## B. Science, technology and innovation for leveraging systemic interlinkages among the Sustainable Development Goals

21. The forum discussed science, technology and innovation solutions for advancing Sustainable Development Goals 1, 2, 3, 8, 10, 12, 13 and 16, including through their interlinkages with the rest of the 2030 Agenda for Sustainable Development. The year 2021 is set to be a landmark year for major United Nations global events, including the Food Systems Summit, the high-level dialogue on energy, the second global Conference on Sustainable Transport, the fifteenth Conference of the Parties to the Convention on Biological Diversity and the twenty-sixth United Nations Climate Change Conference.

22. Science, technology and innovation developments in these areas – energy, transport, agriculture and climate – will have outsized impacts on feasible transformation pathways towards sustainable development in the coming years. Several correspond to the entry points identified in the *Global Sustainable Development Report 2019*. For example, energy underlies all living processes and is responsible for the majority of greenhouse gas emissions, whereas food systems account for one third. Agriculture is responsible for 70 per cent of freshwater withdrawals. One third of the land used for food, fibre and feed production is degraded. Transport is a rapidly rising source of pollution and drives the global economy, so that a comprehensive transformation of the sector will be essential in the current decade.

23. Innovation is the answer to most of the world's global challenges for achieving the Sustainable Development Goals, and it is the only non-exhaustible resource. However, innovation is not just about new technologies, it is also about financing, networking and new business models. To reach impact at scale, new and transformative multi-stakeholder partnerships are needed.

## C. Science, technology and innovation for ending poverty and hunger, and enhancing human well-being and resilience

24. The forum discussed science, technology and innovation solutions in support of ending poverty and hunger, and enhancing human well-being and resilience, including breakthrough innovations, successful experiences and international cooperation.

25. The United Nations Food Systems Summit will be a timely opportunity to highlight the central role of Sustainable Development Goal 2 in the achievement of all other Goals.

26. A range of promising innovations are available to support the achievement of the Sustainable Development Goals, but they require targeted support. Examples discussed included the rapid development of a COVID-19 vaccine; clustered regularly

interspaced short palindromic repeats (CRISPR) gene editing; blockchain technology applications; and satellite imagery and geospatial technologies.

27. A collaborative, systems-based, transdisciplinary approach to innovation is needed. In particular, governments should consider providing more support for dedicated innovation spaces that bring together public and private sectors for mission-oriented innovation for the Sustainable Development Goals, such as the World Food Programme's (WFP) Innovation Accelerator.

28. Stronger commitments to funding science, technology and innovation are necessary in order to make it inclusive and accessible to all countries and to improve lives in the longer run. Each country should have a food systems science policy, and 1 per cent of agricultural gross domestic product should go to research. Climate change makes science, technology and innovation investments in agriculture especially important. In general, research-based knowledge must be promoted. Official development assistance, public private partnerships and blended finance will all be needed to create much-needed public goods.

29. Technologies should not perpetuate inequalities but proactively be directed to reduce them, such as by supporting social protection. They must be adapted to local contexts. Programmes must be accessible and accountable and promote open data. They should foster intergenerational dialogue.

## D. Science, technology and innovation for transforming economies toward equity, sustainability and climate action

30. The forum also discussed science, technology and innovation solutions in support of transforming economies toward equity, sustainability and climate action, including breakthrough innovations, successful experiences and international cooperation.

31. In the context of climate change, biodiversity loss and land degradation, the private sector profits from innovations, while the environmental and social risks of these innovations are often "externalized" to the public. Governments may benefit from implementing circular economy principles and other alternative economic models. Several countries are showing the way with their commitment to promoting circular economy approaches for the sustainable use of natural resources, which are initially focused on sustainable urban mobility plans and government operations themselves.

32. COVID-19 has transformed practices in mobility and transportation while simultaneously accelerating the exchange of ideas through digitalization. This is one area in which changes achieved during the pandemic can support sustainability in the future. Rethinking transportation can help to lower carbon emissions.

33. Climate change and the loss of biodiversity affect many people, particularly the poor, and urgent action is thus required on emissions mitigation, renewable energy and efficient infrastructure and buildings. While the socioeconomic and sustainability benefits are clear, many economic, regulatory, financing, employment and capacity issues must be addressed for an equitable sustainability transition.

34. A range of promising innovations are available to support Sustainable Development Goal achievement. For example, satellite technologies can support climate change resilience and disaster risk reduction by gathering data to monitor geological and weather events. This can support planning and decision-making based on scientific evidence and empower communities with high-quality data. Related conferences organized by Technology Facilitation Mechanism partners, such as the Global Sustainable Technological and Innovation Community (G-STIC), provide further detail on high-impact technology solutions.

## E. Science, technology and innovation for inclusion and effective institutions

35. The forum emphasized the need for inclusive and effective institutions. In particular, it explored advancing the Sustainable Development Goals through inclusive innovation ecosystems that nurture the contributions of all, including the poor, women, youth, indigenous peoples, local communities, people with disabilities and vulnerable groups.

36. Some speakers suggested that accessing reliable information should be a basic human right. However, insufficient consideration is given in this area, especially to people with disabilities, who face a wide range of constraints. Organized science and engineering communities can make a difference by promoting technology for all of society through ethical and inclusive solutions and design standards.

37. Broad cooperation between academic institutions, stakeholders and governments can open up new pathways to integrate local science into everyday policy. Open science initiatives are therefore important in this regard. Accountable, multi-stakeholder collaboration is essential for building support structures for vulnerable groups who are venturing into the field of entrepreneurship.

38. Women and girls are underrepresented in science and technology in many countries, and few women create tech start-up companies. Specific programmes and initiatives for women and girls that provide safe and supportive environments for learning and innovation can make a difference and unlock their potential. Various such programmes were presented at the forum, many of which were sponsored by the private sector, and some of which also focused on peripheral and disadvantaged geographic areas.

39. An increasing number of local and community initiatives in developing countries have leveraged science, technology and innovation, especially online platforms for empowering youth, women and the disabled. They can inspire others to collaborate on technology that has an impact.

40. Decent work is instrumental for the achievement of the Sustainable Development Goals. However, new technologies have a significant impact and role in shaping developments in that area. It is important to maximize new areas of work in green and sustainable economies, through skills development, life-long learning, innovation promotion and international cooperation for inclusive growth and development. This requires work to be decent and to provide men and women equal access to opportunities, thus contributing to a sense of justice in societies.

## F. Technology Facilitation Mechanism findings on the impacts of rapid technology change on the Sustainable Development Goals

41. In line with General Assembly resolutions 72/242 and 73/17, the Assistant Secretary-General for Economic Development and Chief Economist, Elliott Harris, presented an update[2] on the findings of the Technology Facilitation Mechanism regarding the impact of rapid technological change on the achievement of the Sustainable Development Goals. These findings,[3] documented by the inter-agency task team, represented a collaborative, multi-stakeholder effort. Experts from within and outside the United Nations have contributed, including through virtual meetings and more than 40 dedicated science-policy briefs. Substantial contributions were

[2] Available at https://sdgs.un.org/documents/sti-forum-2021presentationelliott-harris-33054.

[3] Technology Facilitation Mechanism, “TFM findings 2021”, 1 May 2021, available at https://sdgs.un.org/sites/default/files/2021-05/TFM%20findings%202021.pdf.

made by the Technology Facilitation Mechanism 10-member group and expert staff from the Department for Economic and Social Affairs, the United Nations Conference on Trade and Development (UNCTAD), the International Telecommunication Union (ITU), the International Labour Organization (ILO), the Economic and Social Commission for Western Asia (ESCWA), the United Nations Environment Programme, the United Nations Industrial Development Organization (UNIDO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Economic and Social Commission for Asia and the Pacific (ESCAP), the United Nations University (UNU), WFP, the United Nations Office for Outer Space Affairs, the United Nations Development Programme (UNDP), the World Intellectual Property Organization (WIPO) and the World Bank, as well as many external experts. A companion inter-agency task team report[4] included individually authored contributions from several of the forum's speakers.

42. The findings explored how things have changed through our experience with COVID-19 and what it might mean for the way forward. It concluded that the 2019 Technology Facilitation Mechanism findings remained valid, but that new elements should be added, in particular those below.

43. COVID-19 has greatly amplified the importance of science, technology and innovation for our well-being and even for our survival. However, it has also exposed weak interfaces with policy and society, and ineffective institutions, which are often the victims of underfunding.

44. COVID-19 has accelerated digitalization, along with its now well-recognized impacts, both positive and negative. Vitally, 3 billion people remain unconnected and are thus still excluded. This has worsened existing technology divides.

45. The crisis has accelerated innovation in medicines, vaccines, biotechnology, digital technologies and artificial intelligence. Scientific discovery and collaboration have sped up, and new ways of delivering services have proliferated.

46. Our pre-pandemic innovation system operated well below its real potential, but we now know we can supercharge it in times of crisis. However, we should not forget that mission-oriented innovation of this type has benefitted from international research and development cooperation and billions in public funding for "vaccine platforms", messenger RNA (mRNA) technology and massive online learning. Therefore, the returns from those must also be made broadly available to the public.

47. The pandemic financial stimulus has been enormous, but it is not yet focused on longer-term measures for a human-centred, green, sustainable research and development and technology-focused recovery. The research and development underinvestment is puzzling: surely the crisis has demonstrated its importance.

48. Public funding for basic research must be greatly expanded and sustained even beyond these times as a vital part of our resilience strategy. For instance, the fundamental biotechnology knowledge that made rapid COVID-19 vaccine development possible was due to years of public funding for basic research.

49. Frontier technologies have made a real difference in COVID-19 responses. Examples include contact tracing applications; space science; viral spread simulations on supercomputers; polymerase chain reaction (PCR) testing; mRNA-based vaccines; synthetic nano-scale antibodies; three-dimensional printing of personal protective equipment; and big data to support policy effectiveness.

[4] Inter-agency task team on science, technology and innovation for the Sustainable Development Goals, "Emerging science, frontier technologies, and the SDGs: perspectives from the UN system and science and technology communities", May 2021, available at https://sdgs.un.org/sites/default/files/2021-05/IATT%20report%20on%20emerging%20techs%202021.pdf.

50. The massive drive for COVID-19 vaccines must be replicated for the 20 neglected tropical diseases which continue to affect one billion people. At the same time, questions of access can no longer be put on the back burner. The task team brought together proponents of open science on the one hand and of strict intellectual property rights on the other. Interestingly, they agreed that there is no fundamental contradiction between the two, and that there are constructive ways forward for addressing the great global challenges.

51. A worldwide, profound techno-economic paradigm transition is under way towards a greener global economy. It creates new windows of opportunity for innovation, productive transformation and new jobs and employment opportunities. This transition must be managed through a process of social dialogue in order to generate a just, fair and inclusive transition process.

52. Science systems must be transformed. The pandemic revealed deficiencies in the capacity of science systems to respond to new priorities in a timely manner while limiting the disruption to ongoing research.

53. The new governance around data makes it complex to rebalance human dignity with economic benefits, which causes fundamental human rights to be put at risk in the new economy. Fair data, transparent algorithms and trustworthy architecture are essential.

54. Digitalization leads to entirely new products and services, with new characteristics that require specific regulatory and policy solutions. For example, the existence of "human digital twins" entails a range of ethical dilemmas. Central bank digital currencies must be regulated to be inclusive, secure, private, accessible and interoperable. Digital labour platforms must be covered by labour regulations to provide decent work.

55. "Deep neural networks" now surpass human cognitive capabilities in narrow, specific tasks, such as facial recognition, some kinds of medical diagnosis and others. Narrow AI has become ubiquitous in many countries, unbeknownst to many. However, billions remain excluded from its benefits. Performance and applications grow at exponential rates, with important implications for the Sustainable Development Goals. For example, artificial intelligence (AI) energy use is expected to increasingly compete with other uses.

56. There are many environmentally compatible frontier technologies which could be deployed across the world. Examples include distributed recycling combined with additive manufacturing, highly energy-efficient AI hardware designs, low-data AI, engineering solutions imitating nature, marine robotics and saltwater greenhouses. There is also a large, untapped potential for highly efficient digital consumer innovations in mobility, food, buildings and energy services.

57. Syntheses of science-policy assessments are important to enable informed and integrated decision-making within the relevant time frame. However, major knowledge and assessment gaps remain with regard to digitalization and other related frontier technology clusters. Independent and in-depth assessments are required.

## G. Emerging science and technology trends and digital cooperation for the Sustainable Development Goals

58. The forum explored the most recent developments in science and technology and their current and potential future impacts on sustainable development, including on how to overcome the digital divide. It connected to the President of the General Assembly's high-level thematic debate on digital cooperation and connectivity, held

on 27 April 2021, and sought synergies for the Technology Facilitation Mechanism with multiple stakeholders active in the follow-up to the Secretary-General's road map on digital cooperation.

59. The forum was briefed by the Vice-Chair of the Commission on Science and Technology for Development, Peter Major, who reported on its 2021 session, which will focus on health and human well-being, blockchain technology applications and progress related to the World Summit on the Information Society. The Commission has repeatedly called for inclusive, international dialogue on frontier technologies and their impacts. It raised the alarm on the fact that the digital divide was turning into a development divide, and that fact required urgent addressing.

60. Science, technology and innovation stakeholders offered their support to work with governments to enable them to keep pace with technological breakthroughs and leverage them towards the common Sustainable Development Goal aspirations. Several Member States have carried out initiatives to harness emerging science and technology in priority sectors to fast-track progress on the Goals. Important aspects included: multi-stakeholder involvement, including academia, the private sector, civil society and the youth; smart, measurable national indicators related to the Goals; and the alignment of science, technology and innovation policy with development plans.

61. Member States shared their experience in promoting emerging science and frontier technologies in the past year. Recurring themes were COVID-19, closing the digital divide, intelligent cities, digital identity, user trust, building capacity and, above all, multilateral and multi-stakeholder collaboration, in order to ensure that no one is left behind.

62. Sustainable Development Goals and national science, technology and innovation plans that elaborate visions for the future can help direct research and development. This is especially important in the context of ambitious goals, such as attaining net zero greenhouse gas emissions. It can help coordinate actions and direct behavioural change towards bringing new technologies to fruition, such as new space-based solar power systems. Ultimately, the best way to predict the future is to invent it. This also applies to frameworks and rules required for AI ethics, to ensure that AI serves humanity as a whole and to address fundamental questions on how to preserve humanity and the planet.

63. Digital access – defined as having access to enough devices and speed and bandwidth to connect globally – should be considered a fundamental human right. Three priorities in digitalization include bringing everyone online, ensuring that digital connectivity is enriching and meaningful, and ensuring that everyone online is safe and secure. There is a need to examine the ways in which people use the Internet and to develop metrics to measure meaningful connectivity, which might include connectivity that supports economic development and vital social services. Above all, affordability remains a barrier for billions of people. AI is likely going to further increase the existing digital divides. It must advance within ethical frameworks and be supported by investments in human skills in order to ensure that it empowers and does not harm people.

64. Economic inclusion and meaningful access are key priorities. A greater focus on how to build equitable access for all is needed. The United Nations could help promote and advance standards for online trust and security.

65. More effective technology governance is needed at all levels. Multi-stakeholder collaboration, while valuable, does not replace the need for inclusive governance. Collaboration between national and local governments must address local issues. Technology is agnostic on the achievement of the Sustainable Development Goals, and there is a need for both "hard" and "soft" governance structures to regulate and

steer technological development to ensure that it will be sustainable. The United Nations was asked to support analysis of how each of the Sustainable Development Goals specifically applies to technology, including documentation of technology-Goal interactions, the development of tools and metrics to quantify technologies' impacts and the promotion of transparency.

66. Trust and security are of particular concern. However, regulation to ensure transparency remains insufficient. Above all, secure online spaces are essential for successful digitalization. Tools have become available to counter false information and to defend and promote trustworthy information, which can be particularly helpful for youth and journalists.

67. The youth are digital natives. With AI becoming ubiquitous, there is a critical need to engage youth in a dialogue, to leverage their talents and instil in them the values of technology for sustainable development.

68. The United Nations can play an important role in digitalization and AI, in particular by promoting a more holistic approach in assessing its impacts. Stronger public and private sectors are essential in addressing the digital divide and helping least developed countries to leapfrog into the future.

## H. Ministerial sessions on science, technology and innovation policies and initiatives for sustainable development: best practices and lessons learned

69. The challenge is to design science, technology and innovation policies and initiatives that translate into effective actions for the Sustainable Development Goals, while respecting national science, technology and innovation priorities and realities.

70. In the ministerial sessions, the forum heard the following countries and political groups share their experiences emphasizing the role of science, technology and innovation as a central element of national development strategies, policies and programmes: Argentina, Belarus, Belgium, Brazil, Chile, China, Colombia, Cuba, the Dominican Republic, El Salvador, Finland, India, Japan, Kenya, Lithuania, Pakistan, Paraguay, the Philippines, the Republic of Korea, Thailand, the United Arab Emirates, the United States of America, Zambia and the European Union. Afghanistan, Egypt, Ghana, Mexico, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland and the MIKTA countries (Mexico, Indonesia, Republic of Korea, Turkey and Australia) provided their statements in written form. The statements are available on the Technology Facilitation Mechanism website.[5]

71. The following is a select list of issues, challenges and recommendations. Science, technology and innovation is seen as the most important instrument not only for the COVID-19 response, but also for recovery and longer-term sustainable development. The pandemic has had an impact on Member States in different ways and to various extents, but it has slowed progress towards the Sustainable Development Goals and increased financing gaps everywhere. Access to vaccines and adequate medical treatment has fallen short in many places. Digitalization and the adoption of AI systems have accelerated. Providing a continued, high-quality education has been a challenge almost everywhere. The significant contribution of the informal sector to development in many countries has been highlighted. Restoring supply chains has been a top priority. International cooperation on research and development and open access to knowledge related to the pandemic featured highly

[5] See https://sdgs.un.org/events/ministerial-session-sti-policies-and-initiatives-sustainable-development-best-practices-and and https://sdgs.un.org/events/ministerial-session-continued-sti-policies-and-initiatives-sustainable-development-best.

in the forum. Distance learning and remote working have irreversibly changed our daily lives and could trigger a creative transformation. It is important to invest in green and digital technologies, research and development, smart jobs, increased productivity and competitiveness.

## I. Supporting national capacities through the Technology Facilitation Mechanism

72. The forum explored how the Technology Facilitation Mechanism could more effectively support national capacities through a One United Nations and multi-stakeholder approach and partnerships spearheaded by the inter-agency task team. National science, technology and innovation road maps for the Sustainable Development Goals can be useful, strategic tools for ensuring policy coherence, linking public and private actions and optimizing investments. Such road maps must be developed at the national and subnational levels, in line with national and global development strategies and with measures for tracking progress. They are also powerful communication tools.

73. The forum was briefed on progress on the inter-agency task team's global pilot programme on science, technology and innovation road maps for the Sustainable Development Goals, from the perspective of the pilot countries (Ethiopia, Ghana, India, Kenya, Serbia and Ukraine). Demand for that programme continues to be higher than what can be supported with available resources. At the time of the forum, 20 Member States had expressed their interest in joining it. The programme has led to a wider inter-agency task team partnership with the Organisation for Economic Co-operation and Development (OECD) and the European Union's Joint Research Centre, including on the development of a joint guidebook to support the preparation of road maps. Recently, the inter-agency task team initiated a "partnership in action" on science, technology and innovation for the Goals road maps, to bring together the international community, governments and the private sector in support of road map development and implementation.

74. The pilot countries have chosen subsets of Sustainable Development Goals, most often Goals 1, 2 and 4. They involved the highest levels of government in the process to develop a vision, goals and targets. Monitoring and evaluation have been critical elements to enable learning from implementation experiences. More resources are needed, both for the development of road maps and for their implementation. Other challenges include the availability of updated data and relevant expertise; insufficient engagement by the private sector, and intellectual property rights and investment issues.

75. The forum was also briefed on complementary, multi-country inter-agency task team training and capacity-building work for government officials, which had been delivered online since the start of the pandemic. In that dedicated work stream, United Nations entities active in the inter-agency task team pooled their capacity-building resources and materials and jointly delivered multi-country training on science, technology and innovation policy and its implementation and on promoting innovation, while sharing experiences among countries.

76. Partnership mechanisms for the Technology Facilitation Mechanism require strengthening in order to more systematically engage science, technology and innovation experts and stakeholders (including academia and philanthropic foundations) in specific activities and projects and to ensure dedicated funding for them.

77. Higher education institutions could play a bigger role in the Technology Facilitation Mechanism in general and inter-agency task team's capacity-building

activities in particular. The Mechanism could identify those institutions that are interested in supporting open science and technology for the Sustainable Development Goals, working with United Nations major groups and the higher education sustainability initiative.

78. The pandemic presents an opportunity to reshape science, technology and innovation policies by highlighting the importance of global research and development and the relevant cooperation. More investment into improving science, technology and innovation education at the secondary and higher levels would be a good start.

## J. Next steps for the Technology Facilitation Mechanism and its partners to deliver on the Sustainable Development Goals

79. The forum engaged in discussions on a collective vision for the future of the Technology Facilitation Mechanism, based on the lessons learned since its very beginnings in 2015. The forum agreed that much has been achieved: it has matured and firmly established science, technology and innovation discussions at United Nations Headquarters in New York and has become the premier United Nations entry point for scientists, innovators and researchers. Yet the forum agreed that more funding for the Mechanism will be essential to support a wider engagement by scientists, engineers and innovators, to forge new partnerships for action and to enable change on the ground. Political commitment and scientific leadership continue to be of paramount importance.

80. Interest in and demand for the Technology Facilitation Mechanism has continued to increase. Renewed efforts are needed to involve a wider range of global science communities and civil society in the planning for and follow-up to the forum, building on existing mechanisms and intersessional dialogue in online and offline formats. The Mechanism's intersessional work should build further links to important events related to science, technology and innovation and similar initiatives within the United Nations system and beyond, in order to amplify the scope of the forum and draw on diverse stakeholder communities.

81. The forum commended the recent progress made in the work of the inter-agency task team and the 10-member group, in particular with respect to its work streams on science, technology and innovation road maps for the Sustainable Development Goal, on capacity-building, on analytical work on emerging science and technologies, on gender and on the operationalization of the 2030 Connect online platform. It called for funding and scaling-up of those activities for greater impact. In addition, the following key issues, challenges and opportunities were identified.

82. Science, technology and innovation capacities must be built, not only for research and development and specific technology solutions, but, most crucially, for the practical deployment of technology solutions on a large scale.

83. Open source science and technologies are an important tool for sustainable development in developed and developing countries alike. However, while millions of product designs are downloadable for free, quality and local suitability vary widely, and therefore a trusted, vetted third-party repository is needed to bring together fragmented resources and provide access through the Technology Facilitation Mechanism's 2030 Connect online platform.

84. Children and youth are highly innovative, and they represent a large share of the population in many developing countries. It is important to tap into that development potential by facilitating young people's access to technologies and by promoting entrepreneurship.

85. The COVID-19 pandemic provides an opportunity to kickstart a sustainable, inclusive and resilient socioeconomic recovery, and to rethink how businesses operate and how Sustainable Development Goals could be reflected in business plans and stakeholder and shareholder values. COVID-19 has demonstrated the value of promoting science, technology and innovation, but also what happens when there is a lack of forward thinking to solve problems, leadership to achieve collective action and commitment to equity to make such action legitimate. Well-informed and accountable leadership is essential. Science, technology and innovation has great potential to solve the major challenges of our time: climate change, education, health, social cohesion and sustainable growth.

86. The pandemic has also highlighted the systemic imbalances of our world, setting back development goals in many countries. It continues to exacerbate inequalities within and between countries. One panellist suggested equal access to digital technologies and science, technology and innovation opportunities to be recognized as a right similar to clean water access. A big push is needed to develop and disseminate the necessary tools, policy advice and technical know-how.

87. The inter-agency task team's "partnership in action" on science, technology and innovation road maps for the Sustainable Development Goals should play a role in that regard. Next steps could include adapting governance and legislation, including in terms of public-private partnerships and financing instruments and strengthened and flexible educational curricula, and addressing the special issues of vulnerable social groups.

88. Integrated technological solutions remain central for sustainable development. Challenges are shared among developed and developing countries, and it is thus crucial to find synergies between methods and technology transfers to scale up the solutions at a global level, in particular for entrepreneurial ecosystems and the youth. Easy and open access to science and technologies is key, as is the capacity to adapt them in order to build customized solutions.

89. The Technology Facilitation Mechanism serves as a big umbrella which brings many partners and networks under its wings to facilitate science, technology and innovation at the national, local and regional levels, while ensuring that the solutions are inclusive and serve as global common goods.

## K. Innovation exhibition and winners of a global call for innovations

90. The 2021 science, technology and innovation forum included a virtual exhibition featuring the winners of two innovation competitions, organized by the Division for Sustainable Development Goals in partnership with the Global Innovation Exchange. The 2021 competition sought innovations developed or adapted to address COVID-19-associated disruptions, while the 2020 call focused more broadly on innovations for transformative change. In all, 25 winners were featured from approximately 1,000 entries.[6]

91. The virtual exhibition included a series of moderated round tables that allowed the innovators to describe their cutting-edge initiatives and share insights from continuing to implement their innovations in the context of the COVID-19 pandemic. The round tables were organized around five themes: food systems, vulnerable communities, education, maternal and child health, and environmental sustainability.

92. Innovators presented a new approach to enriching food with micronutrients, two mobile applications for rural farmers to gain access to high-quality inputs and

[6] See https://sdgs.un.org/tfm/STIForum2021#winners_call_for_innovation.

communicate supply capacity and market demand, and a highly nutritious cereal product made from locally sourced ingredients.

93. Innovators reported on their work to improve the lives of the deaf community, the lesbian, gay, bisexual, transgender, queer and intersex (LGBTQI) community, and those at risk of gender-based violence and mental health issues – areas of acute need in view of the increased rates of child pregnancy and child marriage, and of gender-based violence during the pandemic.

94. Innovators presented digital learning platforms, television and radio programmes dedicated to science, technology, engineering and mathematics learning and other school subjects, and curricula designed to engage girls in technology and experiential learning. During the pandemic, opportunities for e-learning have accelerated, but there has been no change in the importance of pedagogy and "learning by doing" using local materials.

95. Climate-smart technologies were featured, including solar energy and biomass to produce clean-burning briquettes used for cooking and highly efficient medical lighting and power for medical devices and mobile communications. Other innovations promoted the recycling of e-waste in Malaysia or improved sanitation through the provision of gender- and disability-inclusive public toilets in Nepal. Several innovators demonstrated technologies that enabled pregnant women and mothers to monitor their own health and the health of their infants through wearable, non-invasive devices and mobile applications.

96. Although the innovations varied widely in purpose and design, common themes emerged across the panels, including the need to fully engage with local communities to understand needs and encourage the adoption of the technology or initiative. In the context of the COVID-19 pandemic, all innovators attested to the importance of partnerships with governments and other funders and the need to look for the unexpected opportunities that the pandemic provided and to adjust their business plans and approaches to meet new demands.

## L. Side events

97. The following Technology Facilitation Mechanism partners, comprising 14 Member States, 26 United Nations entities and international organizations, 32 civil society organizations and two private sector entities, organized a total of 33 side events on a wide range of topics between 3 and 5 May 2021:[7] Austria, Belgium, Bhutan, Brazil, Finland, Jamaica, Japan, Indonesia, the Philippines, Qatar, Senegal, Singapore, Slovenia, Turkey, Department for Economic and Social Affairs, Food and Agriculture Organization of the United Nations, International Atomic Energy Agency, ILO, International Trade Centre, ITU, ESCWA, Economic Commission for Latin America and the Caribbean, ESCAP, United Nations Office for Outer Space Affairs, Office of the Secretary-General's Envoy on Technology, UNESCO, UNCTAD, UNIDO, UNU, UNDP, United Nations Human Settlements Programme (UN-Habitat), Dag Hammarskjöld Library, Global Pulse, WIPO, WFP, Innovation Cell of the Department of Political and Peacebuilding Affairs, work streams 6 and 9 of the inter-agency task team, OECD, Joint Research Centre of the European Commission, United Nations Sustainable Development Solutions Network, Action Group on Erosion, Technology and Concentration, United Nations Major Group for Children and Youth, Society for International Development, Civil Society Financing for Development Group, Engineering Academy of Japan, International Federation of Library Associations and Institutions, Hernan Santa Cruz Library, Women's Major

[7] See https://sdgs.un.org/tfm/STIForum2021#side_events.

Group, Asia Pacific Regional Civil Society Engagement Mechanism, World Federation of Engineering Organizations, Institute of Electrical and Electronics Engineers, G-STIC, University of Sussex, University College London, CANEUS International, Fund for the Development of the Indigenous Peoples of Latin America and the Caribbean, Carnegie Council on Ethics and International Affairs, Afri-health Optonet Association, the Society for Conservation and Sustainability of Energy and Environment in Nigeria, Dr. Uzo Adirieje Foundation, International Association for the Advancement of Innovative Approaches to Global Challenges, Education, Communication and Outreach Stakeholders Community, Local Governments for Sustainability, Climate Chain Coalition, GloCha Foundation NY, Generation Next Voice of Youth, International Science Council, Oswaldo Cruz Foundation, Engineering for Change, American Society of Mechanical Engineers, Springer Nature and GloCha Tech GesmbH public-benefit corporation.

# IV. Recommendations for consideration

98. The Forum highlighted many practical examples and proposed recommendations for action by the United Nations system, governments, businesses, scientists, academia, civil society and others. The necessity of international science, technology and innovation cooperation and of multi-stakeholder approaches was repeatedly underscored. The following issues may be considered by decision makers, in addition to the wider range of recommendations on how to address the challenges in the areas contained in section II above.

## A. General recommendations

99. The COVID-19 pandemic has allowed us to rethink and reimagine solutions to the major problems we face. This is not only a challenge but also an opportunity for creative destruction leading to breakthrough innovations and new integrated approaches and strategies.

100. Investments in science, technology and innovation for education and youth are crucial to build related competencies for the future, including in platforms for open innovation, since they enable young people to become the technology entrepreneurs of the future. It is also crucial to engage women and girls in science and technology to unlock their innovative potential.

101. Extraordinary levels of international cooperation on research, infrastructure, access and capacities are needed in order to overcome the technology gaps within and between countries and social groups and to avoid long-run low-technology traps. Governments can promote much-needed technology transfers by collaborating across borders, including through South-South cooperation.

102. Inclusive planning is essential for building stronger innovation systems and involves co-design by innovators and users from all backgrounds. In general, the participation of, and partnerships between, science communities, funders, academia and the private sector must be further expanded and deepened, and partnerships are essential.

103. There is a need for greater governance and regulation of technologies in order to monitor their impacts on the Sustainable Development Goals, incentivize sustainable action in technology and ensure transparency across the sector. Governments can increase transparency by advancing both hard and soft regulations to help steer the direction of new technological developments and promote company disclosure. A forward-looking perspective is required to assess the opportunities and

challenges related to the impacts of emerging science and frontier technologies on the Sustainable Development Goals. The United Nations can help to demonstrate how technology impacts the Goals and to promote related assessments.

104. With digitalization having become a pervasive trend, it is of paramount importance to connect the entire world with high-quality, reliable and affordable Internet connectivity, enabled by universal access to electricity. Major efforts are needed to build modern digitalization infrastructure that includes high-capacity computing, the Internet of things, access to AI services and a range of general-purpose technology platforms. Digital literacy and skills must be developed, and human rights online protected.

## B. Recommendations on lessons from COVID-19

105. Long-term investments through life-long learning are essential in the areas of basic science, mission-oriented innovation, scientific literacy, digital infrastructure, digital skills and literacy – including media and information literacy – and, above all, effective science-policy interfaces. They have the potential to accelerate innovations to also solve other great global challenges.

106. Research priorities must adequately address truly global public goods problems and should be supported by strengthened international collaboration mechanisms.

107. Global efforts are needed to reduce extreme inequalities in knowledge, innovation and production capabilities. Otherwise, public health and other sustainable development responses might be rendered ineffective. Universal, high-quality Internet access must be achieved as a matter of priority.

108. The worldwide free flow of scientific and technological knowledge, data and ideas must be promoted and guaranteed across national and disciplinary borders.

109. Lessons learned from changing production and delivery systems, including the roles of automation and AI, should be considered by policymakers and supported by the United Nations to build resilience to future shocks.

## C. Recommendations for the Technology Facilitation Mechanism

110. The Technology Facilitation Mechanism has become the premier multi-stakeholder mechanism in the United Nations system for advancing science, technology and innovation applications for the Sustainable Development Goals. The Mechanism has demonstrated a novel One United Nations, multi-stakeholder way of working for the United Nations system which is entirely new and, since its establishment, has newly engaged various science, technology and innovation communities and many individual experts with the United Nations.

111. Going forward, the forum will continue to strengthen its convening power for dialogues between stakeholders and governments and for sharing ideas and catalysing new initiatives and partnerships. It will continue to help to identify practical means and solutions to foster science, technology and innovation in all countries. The following recommendations also benefited from a special session with the 10-member group that reflected specifically on potential next steps for the Technology Facilitation Mechanism. They complement and build on earlier lessons learned that were documented by the inter-agency task team.

112. Continued demand for the multi-stakeholder science, technology and innovation forum and its science-policy interface function in support of the Sustainable Development Goals is apparent. Given the high expectations for the Mechanism,

Member States and stakeholders should consider strengthening their political and financial support for the Mechanism, in order to scale up their activities in the inter-agency task team work streams, the 10-member group and the 2030 Connect online platform.

113. The multi-stakeholder Technology Facilitation Mechanism should continue to improve the inclusion of stakeholders and associated related events and improve coordination with the United Nations system and other international organizations. Support is required for even greater participation in the forum by government representatives and innovators from developing countries.

114. Open science and technology are crucial tools for solving humanity's great global challenges. The Technology Facilitation Mechanism could explore the establishment of a global database, which would be accessible to all, on proven open source technologies. Similarly, insights that have been gathered by the Mechanism on Sustainable Development Goal-specific technology solutions, as well as on high-impact, integrated technology solutions across the Goals, together with information on their socio-technical feasibility and potential impacts, should be made available. Both can be enabled through the 2030 Connect online platform and seek synergies with and draw on similar initiatives and efforts.

115. The Technology Facilitation Mechanism should follow up with the hundreds of innovators who have participated in the United Nations call for technology innovations for the Sustainable Development Goals every year since 2016. It should explore creating partnerships for supporting the scaling-up of these and similar innovations and for making them available through the 2030 Connect online platform.

116. Regional and national science, technology and innovation forums might be held and systematically linked to the annual global forum. These and other relevant conferences and events within and outside the United Nations may be associated with and consider presenting their findings on science, technology and innovation to the forum.

117. United Nations experts in the inter-agency task team, in the 10-member group and among Technology Facilitation Mechanism stakeholders constitute an important source of technical expertise which should be systematically harnessed. The work of the inter-agency task team on science, technology and innovation road maps for the Sustainable Development Goal; on capacity-building; on analytical work on emerging science and frontier technologies and the Sustainable Development Goals; on gender; and on 2030 Connect deserves full support and engagement. Recommendations by earlier forums on these work streams provide further details.

118. The Technology Facilitation Mechanism should promote dialogues and stronger collaboration with related initiatives being conducted by United Nations entities, other international organizations and different stakeholders, most notably the Office of the Secretary-General's Envoy on Technology.

119. The Technology Facilitation Mechanism should continue building partnerships and interfaces with universities, innovation incubators and private sector entities that are at the forefront of technological change, promoting breakthrough innovations and facilitating a two-way exchange of real-time information, engagement and policy insights.

120. The Technology Facilitation Mechanism should further promote international cooperation on science, technology and innovation policy and plans and strengthen its capacity-building support, including in the context of its "partnership in action" on science, technology and innovation road maps for the Sustainable Development Goals.

121. Analytical work by the inter-agency task team and its partners could consider taking a more forward-looking perspective, including the use of horizon-scanning and quantitative scenarios in support of sustainable and ethical use and governance of frontier technologies in the post COVID-19 era.

122. Over the coming 9 years, future forums should learn from and advance the achievements of previous ones. The forum might become the outcome of an annual programme of results-oriented activities in the inter-agency task team subgroups, in close cooperation with the 10-member group.