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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 the Republic of Latvia to the UN, Andrejs Pildegovičs, and the Chargé d'Affaires of the Permanent Mission of the Republic of Indonesia to the UN, 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 (STI Forum). 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 STI Forum. As a component of the Technology Facilitation Mechanism (TFM), the Forum is a venue to discuss cooperation in science, technology and innovation (STI) around thematic areas pertaining to the implementation of the Sustainable Development Goals (SDGs), 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 SDGs in the light of COVID-19; and to help facilitating the development, transfer and dissemination of relevant technologies for the Goals and targets.

3.   The Permanent Representative of the Republic of Latvia to the UN, Andrejs Pildegovičs, and the Chargé d'Affaires of the Permanent Mission of the Republic of Indonesia to the UN, Mohammad Koba, co-chaired the Forum. The Forum was prepared by the UN Inter-agency Task Team on Science, Technology and Innovation for the Sustainable Development Goals (IATT), 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 TFM.

4.   The opening of the Forum featured statements by the President of the Economic and Social Council, Munir Akram, the President General Assembly, Volkan Bozkir, and the Secretary-General of the UN (remarks delivered by the OIC of the UN 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, 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, including 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 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; special events on reflections by 10-Member-Group members; on STI and harnessing global opportunities for transformations in 2021; on digital cooperation; and on promoting inclusion to accelerated innovation; as well as 33 side events. The Forum also included Ministerial sessions which featured 24 live statements on STI policies and initiatives from ministers and other high-level speakers, and an additional 7 written statements.

II.   Highlights of discussions at the STI 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 R&D and STI solutions for "building back better" and accelerating progress towards the SDGs, with an emphasis on SDGs 1, 2, 3, 8, 10, 12, 13, 16 and 17 which are the in-focus SDGs under review at HLPF 2021. The Forum examined promises and potential risks of emerging science and technologies and discussed technological and capacity divides. It linked directly to IATT workstreams on STI4SDG roadmaps, emerging science and technologies, capacity building, gender, and the TFM online platform. It concluded with a discussion of opportunities and the way forward for the TFM 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, scaling up the 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 TFM.

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 on in later sessions.

STI 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. This included reflections on the response of the scientific community to the pandemic, its impact on open science, building trust in science, support for the socio-economic recovery, including the role of creative economy sector, advancement of gender equality, as well as lessons-learned on how to better harness science and technology to resolve global challenges.

10.   Science, technology and innovation have enabled to world to soften the impact of the COVID-19 pandemic at individual, social, and economic levels, compared to what would have happened, if the pandemic had occurred 30 years ago with no teleworking, no video conferencing, no telemedicine, no remote learning and limited ways 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 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 and primarily through public R&D funding. One of the lessons has been that sustainable resilience warrants 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 complex societal problems for which an effective science-policy interface is essential. Even though research greatly sped up, it continued to be relatively slow compared to the speed with which the political world needed to act. This holds 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. Last year, 75,000 scientific articles were published on COVID-19, more than 70% 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 WHO declared the pandemic, several highly affective vaccines have become available and 1.01 billion vaccine doses had already been administered, as of 24 April 2021.[1] At the same time, vaccine distribution and uptake has been deeply unequal across countries. The pandemic is a stress test to our

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

science, technology and health systems and has revealed areas that need strengthening to improve preparedness for crises.

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

15. COVID-19 is imposing a new type of economy which is based on STI and new forms of social organization. It is thus more important than ever to spread STI 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 large range of technology applications and innovations that underpin this new economy. Examples include decentralised 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 call for 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, but there had been many warnings. In fact, changes in ecology, environment, urbanization, trade, travel, neglect of public health and limitations in international cooperation have created a perfect storm that has made these kinds of pandemics more likely to happen. There are similar warnings on other sustainability events which 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.

19. There is a risk we will give digital transformation a bad name in the coming years, if we do not make sure 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, which has socio-political impacts until today. The pandemic has already increased socio-economic inequalities worldwide and has set back development by many years in some countries. Access to STI resources have 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 R&D funding. In particular, international collaboration mechanisms need strengthening and adequate funding.

STI for leveraging systemic interlinkages among the SDGs

21. The Forum discussed STI solutions for advancing SDGs 1, 2, 3, 8, 10, 12, 13 and 16, including through their interlinkages with the rest of the 2030 Agenda. The year 2021 is set to be a landmark year with major UN global events, including the Food Systems Summit, the High-level Dialogue on Energy, the second global Sustainable Transport Conference, the UN Biodiversity Conference (COP15) and the UN Climate Change Conference (COP26).

22. STI developments in these areas – energy, transport, agriculture, 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 GHG emissions, whereas food systems account for one third. Agriculture is responsible for 70% 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 present decade.

23. Innovation is the answer to most of the world's global challenges for achieving the SDGs, 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.

STI for ending poverty and hunger, enhancing human well-being and resilience

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

25. The UN Summit on Sustainable Food Systems will be a timely opportunity to highlight the central role of SDG2 in the achievement of all other SDGs.

26. A range of promising innovations are available to support SDG achievement, but they need targeted support. Examples discussed included the rapid development of a COVID-19 vaccine; CRISPR gene editing; blockchain technology applications; satellite imagery and geospatial technologies.

27. A collaborative, systems-based, trans-disciplinary approach to innovation is needed. In particular, Governments should consider providing more support for dedicated innovation spaces which bring together public and private sectors for mission-oriented innovation for the SDGs, such as the WFP's Innovation Accelerator

28. Stronger commitments to funding STI are necessary, in order to make it inclusive, and accessible to all countries, and to ultimately improve lives in the longer run. Each country should have a food systems science policy and 1% of agricultural GDP should go to research. Climate change makes STI investments in agriculture especially important. In general, research-based knowledge needs to be promoted. ODA, public private partnerships, 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 need to be adapted to the local contexts. Programmes need to be accessible and accountable and promote open data. They should foster inter-generational dialogue.

STI for transforming economies toward equity, sustainability and climate action

30. The Forum also discussed STI solutions in support of transforming economies toward equity, sustainability and climate action including breakthrough innovations and 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 advance circular economy approaches for the sustainable use of natural resources, which is initially focused on sustainable urban mobility plans and government operations themselves.

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

33. Climate change and loss of biodiversity affect many people, particularly the poor, which calls for urgent action on emissions mitigation, renewable energy and efficient infrastructure and buildings. While the socio-economic 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 SDG achievement. For example, satellite technologies can help 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 TFM partners, such as GSTIC, provide further detail on high-impact technology solutions.

STI for inclusion and effective institutions

35. The Forum emphasized the need for inclusive and effective institutions. In particular, it explored advancing the SDGs 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. Yet, insufficient consideration is taken especially for people with disability who also face a wide range of constraints. Organized science and engineering communities can make a difference by advancing technology for all of society, by promoting 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, hence the importance of open science initiatives 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 only 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, 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 STI and especially online platforms for empowering youth, women and the disabled. They can inspire others to collaborate on technology that is impactful.

40. Decent work is instrumental for the achievement of the SDGs. Yet, it is greatly impacted and shaped by new technologies. 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. It requires work to be decent, giving both men and women equal access to opportunities, which contributes to a sense of justice in societies.

TFM findings on the impacts of rapid technology change on the SDGs

41. In line with General Assembly resolutions 72/242 and 73/17, UN Chief Economist and ASG for Economic Development, Elliott Harris, presented[2] an update on the findings of the TFM on the impact of rapid technological change on the achievement of the SDGs. These findings[3] documented by the inter-agency task team, represented a collaborative, multi-stakeholder effort Experts from within the UN and outside have contributed, including through virtual meetings and over 40 dedicated science-policy briefs. Substantial contributions were made by the TFM 10-Member Group, and expert staff from DESA, UNCTAD, ITU, ILO, ESCWA, UNEP, UNIDO, UNESCO, ESCAP, UNU, WFP, OOSA, UNDP, WIPO, and World Bank, as well as many external experts. A companion IATT 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 TFM findings remained valid, but that new elements would need to be added, in particular, the following:

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

44. COVID-19 has accelerated digitalisation, along with its now well-recognized impacts, both positive and negative. Vitally, 3 billion unconnected are 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 collaborations have sped up, new ways of delivering services have proliferated.

46. Our pre-pandemic innovation system had operated well below its real potential, but we can supercharge it in times of crisis. However, we should not forget that mission-oriented innovation of this type has benefitted from international R&D cooperation and billions in public funding for "vaccine platforms", mRNA technology and massive online

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[2] Available from https://sdgs.un.org/documents/sti-forum-2021presentationelliott-harris-33054
[3] https://sdgs.un.org/sites/default/files/2021-05/TFM%20findings%202021.pdf
[4] https://sdgs.un.org/sites/default/files/2021-05/IATT%20report%20on%20emerging%20techs%202021.pdf

learning. Therefore, the returns from these must also be broadly available to the public.

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

48. Public funding for basic research needs to 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 apps; space science; viral spread simulations on supercomputers; PCR testing; mRNA-based vaccines; synthetic nano-scale antibodies; 3D printing of PPE; and big data to support policy effectiveness.

50. Massive drive for COVID 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 innovations, productive transformation, and new jobs and employment opportunities. This transition needs to be managed in 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 re-balance human dignity with economic benefits, thereby putting fundamental human rights at risk in the new economy. Fair data, transparent algorithms, and trustworthy architecture are essential.

54. Digitalisation leads to entirely new products and services with new characteristics that require specific regulatory and policy solutions. For example, human digital twins entail a range of ethical dilemmas. Central bank digital currencies must be regulated to be inclusive, secure,

private, accessible and interoperable. Digital labour platforms need to 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 SDGs. For example, 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 in relevant time. However, major knowledge and assessment gaps remain with regard to digitalisation and other related frontier technology clusters. Independent and in-depth assessments are needed.

Emerging science and technology trends and digital cooperation for the SDGs

58. The Forum explored the latest developments in science and technology and their current and potential future impacts on sustainable development, including on how the digital divide could be overcome. It connected to the PGA's high-level thematic debate on digital cooperation and connectivity, held on 27 April 2021, and sought TFM synergies with multiple stakeholders active in the follow-up to the SG's roadmap on digital cooperation.

58. The Forum was briefed by the Chair of CSTD, Peter Major, on its 2021 session which will focus on health and human well-being, on block chain technology applications, and on progress related to the World Summit on Information Society. CSTD has repeatedly called for inclusive, international dialogue on frontier technologies and their impacts. It has raised alarm that the digital divide was turning into a development divide which required urgent addressing.

59. STI stakeholders offered their support to work with Governments to keep pace with technological breakthroughs and how to leverage them towards the common SDG aspirations. Several Member States have carried out initiatives to harness emerging science and technology in priority sectors to fast-track SDG progress. Important aspects included: multi-stakeholder involvement, including academia, private

sector, civil society and youth; smart, measurable, national indicators related to the SDGs; and the alignment of STI policy to development plans.

60. 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 none is left behind.

61. SDGs and national STI plans that elaborate visions for the future can help direct R&D. This is especially important in the context of ambitious goals, such as attaining net zero GHG emissions. It can help coordinate actions and direct behavioural change towards bringing new technologies to fruition, such as new space solar power systems. Ultimately, the best way to predict the future is to invent it. This also applies to frameworks and rules which we need 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.

62. Digital access - defined as having access to enough devices, speed and bandwidth to connect globally – should be considered a fundamental human right. Three priorities in digitalization include bringing everyone online, ensuring that the digital connectivity is enriching and meaningful, and making sure 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 needs to advance with ethical frameworks and to be supported by investments in human skills, in order to ensure that it empowers and does not harm people.

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

64. 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 needs to address local issues. Technology is agnostic to the achievement of the SDGs, 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 UN was asked to support analysis of how each of the SDGs specifically applies to technology, including documentation of technology-SDG interactions, development of tools and metrics to quantify technologies' impacts; and promoting transparency.

65. Trust and security are of particular concern. Yet regulation to ensure transparency has remained 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.

66. 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.

67. The UN can play an important role in digitalization and AI, particularly in promoting a more holistic approach in assessing impacts. Stronger public and private sectors are essential in addressing the digital divide and helping LDCs leapfrog into the future.

Ministerial sessions on STI policies and initiatives for sustainable development – best practices and lessons-learned

68. The challenge is to design STI policies and initiatives that translate into effective actions for the SDGs, while respecting national science, technology and innovation priorities and realities.

69. In the Ministerial sessions, the Forum heard the following countries and/or political groups share their experiences emphasizing the role of STI as a central element of national development strategies, policies, and programmes: European Union, Colombia, Finland, India, the Philippines, Dominican Republic, China, Belarus, Thailand, Kenya, Pakistan, El Salvador, Brazil, Paraguay, Japan, Zambia, Lithuania, Cuba, United Arab Emirates, Republic of Korea, Chile, Argentina, United States of America, and Belgium. Afghanistan, Egypt, Ghana, Mexico, Russian Federation, the United Kingdom, and MIKTA countries (Mexico, Indonesia, Republic of Korea, Turkey and Australia) provided their statement written form. These statements are available on the TFM Website.[5]

70. The following is a selective list of issues, challenges and recommendations made. STI is seen not only as the most important instrument in the COVID-19 response, but also for the recovery and longer-term sustainable development. The pandemic has impacted Member States in different ways and to various extents, but it has slowed progress towards the SDGs and increased financing gaps everywhere. Access to vaccines and adequate medical treatment has fallen short in many places. Digitalisation 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 R&D cooperation and open access to knowledge related the pandemic featured highly. Distance

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

learning and remote working have irreversibly changed our daily lives and could trigger a creative transformation. It is important to invest into green and digital technologies, R&D, smart jobs, increased productivity and competitiveness

Supporting national capacities through the TFM

71. The Forum explored how the TFM could more effectively support national capacities through a one-UN and multi-stakeholder approach and partnerships spearheaded by IATT. National STI4SDG roadmaps can be useful, strategic tools for ensuring policy coherence, linking public and private actions, and optimizing investments. These roadmaps need to 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.

72. The Forum was briefed on progress with the IATT's global pilot programme on STI4SDG roadmaps, from the perspective of the pilot countries - Ethiopia, Ghana, India, Kenya, Serbia, and Ukraine. Demand for this 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 of joining it. The programme has led to a wider IATT partnership with OECD and the EU's Joint Research Centre, including on the development of a joint guidebook to support preparation of roadmaps. Recently, IATT initiated a Partnership in Action on STI4SDG roadmaps, to bring together international community, governments and the private sector in support of roadmap development and implementation.

73. The pilot countries have chosen subsets of goals, most often including SDGs 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 in order to enable learning from the implementation experiences. More resources are needed both for the development of roadmaps and for their implementations. Other challenges include the availability of updated data and relevant expertise; insufficient engagement by the private sector, as well as IPR and investment issues.

74. The Forum was also briefed on complementary, multi-country IATT training and capacity building work for government officials which had been delivered online since the start of the pandemic. In this dedicated work stream, UN entities active in the IATT have pooled their capacity building resources and materials and jointly delivered multi-country training on STI policy, its implementation and on promoting innovation, while sharing experiences among countries.

75. Partnership mechanisms for the TFM need strengthening to more systematically engage STI experts and stakeholders (including academia and philanthropic foundations) in specific activities and projects and to ensure dedicated funding for them.

76. Higher education institutions could play a bigger role in the TFM in general and IATT's capacity building activities in particular. The TFM could identify those institutions that are interested in supporting open science and technology for the SDGs, working with UN major groups and the higher education sustainability initiative.

77. The pandemic presents an opportunity to reshape STI policies by highlighting the importance of global R&D and STI cooperation. More investment into improving STI education at the secondary and higher levels would be a good start.

Next steps for the TFM and its partners to deliver on the SDGs

78. The Forum engaged in discussions on a collective vision for the future of the TFM, 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 STI discussions at UN headquarters in New York and has become the premier UN entry point for scientists, innovators and researchers. Yet, the Forum agreed that more funding for the TFM will be essential to support a wider engagement of scientists, engineers and innovators, to forge new partnership for action, and enable change on the ground. Political commitment and scientific leadership continue to be of paramount importance.

79. Interest in and demand for the TFM has continued to increase. Renewed efforts are needed to involve a wider range of global science communities and civil society in the planning and follow-up of 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 STI-related events and initiatives within the UN system and beyond, in order to amplify the scope of the forum and draw on diverse stakeholder communities.

80. The Forum commended recent progress in the work of the IATT and the 10-Member-Group, in particular with respect to its work streams on STI for SDG roadmaps, on capacity building, on analytical work on emerging science and technologies, on gender, and on operationalization of the online platform, 2030 Connect. It called for funding and scaling up of these activities for greater impact. In addition, the following key issues, challenges and opportunities were identified.

81. Science, technology and innovation capacities need to be built, not only for R&D and for specific technology solutions, but, most crucially, for practical deployment of technology solutions on a large scale.

82. Open source science and technologies are an important tool for sustainable development in developed and developing countries alike. But, while millions of product designs are downloadable for free, quality and local suitability vary widely, which calls for a trusted, vetted third-party repository to bring together the fragmented resources and provide access through the TFM online platform "2030 Connect".

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

84. The COVID-19 pandemic provides an opportunity to kickstart a sustainable, inclusive, and resilient socio-economic recovery, and to rethink how businesses are operated and how SDGs could be reflected in business plans, stakeholder and shareholder values. COVID-19 has demonstrated the value of promoting STI, but also shown what happens when there is 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. STI has great potential to solve the major challenges of our time: climate change, education, health, social cohesion and sustainable growth.

85. But the pandemic 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 panelist suggested equal access to digital technologies and STI 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.

86. The IATT's Partnership in Action on STI4SDGs Roadmaps should play a role in this regard. Next steps could include adapting governance and legislation, including in terms of public-private partnerships and financing instruments, strengthened and flexible educational curricula, and addressing special issues of vulnerable social groups.

87. 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, including in particular the entrepreneurial ecosystems and the youths. Easy and open access to science and technologies is key, as well as capacity to adapt them to build customized solutions.

88. The TFM serves the role of a "big umbrella" which brings many partners and networks under its wings to facilitate STI on national, local, and regional levels, while ensuring that the solutions are inclusive and serve as global common goods.

Innovation exhibition and winners of a global call for innovations

89. The 2021 STI Forum included a virtual exhibition featuring the winners of two innovation competitions organized by the UN 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 had focused more broadly on innovations for

transformative change. In all, 25 winners were featured from around one thousand entries.[6]

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

91. Innovators presented a new approach to enriching food with micronutrients, two mobile apps for rural farmers to gain access to high quality inputs and communicate supply capacity and market demand, and a highly nutritious cereal product made from locally sourced ingredients.

92. Innovators reported on their work to improve the lives of the deaf community, the LGBTQIA community, and those at risk of gender-based violence and mental health issues – areas of acute need in view of increased rates of child pregnancy and child marriage, gender-based violence during the pandemic.

93. Innovators presented digital learning platforms, television and radio programs dedicated to STEM 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.

94. 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 providing 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 apps.

95. Though 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 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 unexpected opportunities that the pandemic provided and to adjust their business plans and approaches to fill new demands.

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

Side events

96. The following TFM partners - comprising 14 Member States, 26 UN 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, Philippines, Senegal, Singapore, Slovenia, Turkey, Qatar, DESA, FAO, IAEA, ILO, ITC, ITU, ESCWA, ECLAC, ESCAP, OOSA, Office of SG's Tech Envoy, UNESCO, UNCTAD, UNIDO, UNU, UNDP, UN-Habitat, UN library, UN Global Pulse, WIPO, WFP, Innovation Cell/DPPA, IATT WS6 and WS9, OECD, EC/JRC, SDSN, ETC Group, MGCY, SID, Civil Society Financing for Development Group, Engineering Academy of Japan, IFLA, Biblioteca Hernan Santa Cruz, Women Major Group, CSO FfD Group, AP-RCEM, WFEO, IEEE, G-STIC, University of Sussex, University College London, CANEUS, FILAC, Carnegie Council on Ethics in International Affairs, Afrihealth Optonet Association, SOCSEEN, DUZAFOUND, IAAI, ECOS, ICLEI, Climate Chain Coalition, GloCha Foundation NY, Generation Next Voice of Youth, ISC, Fiocruz, Engineering for Change, ASME, Springer Nature, and GloCha Tech GesmbH public-benefit corporation.

IV. Recommendations for consideration

97. The Forum highlighted many practical examples and proposed recommendations for action by the UN system, Governments, businesses, scientists, academia, civil society and others. The necessity of international STI 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 the previous section II above.

General recommendations

98. 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.

99. Investments in STI for education and youth are crucial to build STI competencies for the future, including in platforms for open innovation, since it enables 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.

100. 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, in

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

order to avoid long-run, low-technology traps. Governments can advance much needed technology transfer by collaborating across borders, including through South-South collaborations.

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

102. There is a need for greater governance and regulation of technologies, in order to monitor their impacts on the SDGs, 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 needed to assess the opportunities and challenges related to the impacts of emerging science and frontier technologies on the SDGs. The UN can help demonstrate how technology impacts the SDGs and promote related assessments

103. 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 infrastructures that include high-capacity computing, Internet of Things, access to AI services and a range of general purpose technology platforms. Digital literacy and skills need to be developed and human rights online protected.

Recommendations on lessons from COVID-19

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

105. Research priorities need to adequately address truly global public goods problems and should be supported by strengthened international collaboration mechanisms.

106. Global efforts are needed to reduce extreme inequalities of 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.

107. The world-wide free flow of scientific and technological knowledge, data and ideas need to be promoted and guaranteed across national and disciplinary borders.

108. Lessons-learned from changing production and delivery systems, including the roles of automation and AI, should be considered by policy makers and supported by the UN in support of building resilience to future shocks.

Recommendations for the TFM

109. The TFM has become the premier multi-stakeholder mechanism in the UN system for advancing STI applications for the SDGs. The TFM has demonstrated a novel one-UN, multi-stakeholder way of working for the UN system which is entirely new and since its establishment has newly engaged various STI communities and many individual experts with the UN.

110. 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 reflecting specifically on potential next steps for the TFM. They complement and build on earlier lessons-learned that have been documented by IATT.

111. Continued demand for the multi-stakeholder STI Forum and its science-policy interface function in support of the SDGs is apparent. Given the high expectations for the TFM, Member States and stakeholders should consider strengthening their political and financial support for the Mechanism, in order to scale-up their activities in the IATT work streams, the 10-Member-Group and the online platform 2030 Connect.

112. The multi-stakeholder TFM should continue to improve inclusion of stakeholders and associated related events and improve coordination with UN system and other international organizations. Support is needed for even greater participation in the forum by government representatives and innovators from developing countries.

113. Open science and technology are crucial tools for solving humanity's great global challenges. The TFM could explore the establishment of a global database – accessible for all - on proven open source technologies 1 Similarly, insights that have been gathered by the TFM on SDG-specific technology solutions, as well as on high impact, integrated technology solutions across SDGs, together with information on their socio-technical feasibility and potential impacts should be made available. Both can be enabled through the online platform 2030 Connect and seek synergies with and drawing on similar initiatives and efforts.

114. The TFM should follow-up with the hundreds of innovators who have participated in the UN call for technology innovations for the SDGs every year since 2016. It should explore creating partnerships for supporting the scaling up these and similar innovations and for making them available through the online platform 2030 Connect.

115. Regional and national STI Forums might be held and systematically linked to the annual global Forum. These and other relevant conferences and events within and outside the UN may be associated with and consider presenting their STI findings to the forum.

116. UN experts in the IATT, in the 10-Member Group and among TFM stakeholders constitute an important source of technical expertise which should be systematically harnessed. The work of IATT on STI4SDG roadmaps; on capacity building; on analytical work on emerging science and frontier technologies and the SDGs; on gender; as well as on 2030 Connect deserve full support and engagement. Recommendations by earlier Forums on these work streams provide further details.

117. The TFM should promote dialogues and stronger collaborations with related initiatives being conducted by UN entities, other international organizations and different stakeholders, most notably the Office of the Secretary General's Envoy on Technology.

118. The TFM 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.

119. The TFM should further promote international cooperation on STI policy and plans and strengthen its capacity building support, including in context of its Partnership in Action on STI4SDG roadmaps.

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

121. 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 IATT subgroups in close cooperation with the 10-Member-Group.

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