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Multi-stakeholder Forum on Science, Technology and Innovation for the Sustainable Development Goals

Note by the Secretariat[1]

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 in person on 3 and 4 May 2023, with additional special events held on 2 and 5 May. The Co-Chairs of the Forum, H.E. Ms. Mathu Joyini, Ambassador and Permanent Representative of the Republic of South Africa to the United Nations, and H.E. Mr. Thomas Woodroffe, Ambassador of the United Kingdom to the UN Economic and Social Council, were appointed by the President of the Council. This summary is circulated pursuant to paragraph 123 of the Addis Ababa Action Agenda (GA resolution 69/313) and paragraph 70 of the 2030 Agenda for Sustainable Development (resolution 70/1).

[1] The report was submitted late to incorporate the latest changes.

I. Introduction

1. This summary represents a reflection of the broad discussions that took place during the 2023 session of the Multi-stakeholder Forum on Science, Technology and Innovation for the Sustainable Development Goals (STI Forum). It brings together a diverse set of views articulated through both formal and informal statements provided by representatives of governments, the UN-system and diverse 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 3 and 4 May 2023, the President of the Economic and Social Council, H.E. Ms. Lachezara Stoeva, convened the eighth annual STI Forum – one 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). It is mandated to facilitate interaction, networking, and the establishment of networks and multi-stakeholder partnerships. It discusses technology needs and gaps, promotes scientific cooperation, innovation, and capacity-building, and examines the impact of rapid technological change on sustainable development perspectives.

3. H.E. Ms. Mathu Joyini, Ambassador and Permanent Representative of the Republic of South Africa to the UN, and H.E. Mr. Thomas Woodroffe, Ambassador of the United Kingdom to the UN Economic and Social Council, co-chaired the Forum. The Forum was jointly organized by the UN Inter-agency Task Team on Science, Technology and Innovation for the Sustainable Development Goals (IATT), coordinated by DESA and UNCTAD, as well as by the 10-Member-Group of High-level Representatives of Scientific Community, Civil Society, and Private Sector in support of the Technology Facilitation Mechanism (10-Member-Group), appointed by the Secretary-General and serviced by DESA.

4. The Forum was held in person at UN headquarters in New York. This year's theme was *Science, technology and innovation for building back better from COVID-19 while advancing the full implementation of the 2030 Agenda for Sustainable Development at all levels*.

5. The Forum was well attended by scientists, innovators, technology specialists, civil society, entrepreneurs, innovators, and by representatives of governments, UN system, academia, civil society, youth and private sector. 16 statements were delivered during the Ministerial session of the Forum. The official programme of the Forum featured over 100 hundred key speakers, and numerous more spoke in 22 in-person side events and other related events. More than 300 scientists and engineers submitted science-policy briefs to raise attention among policy makers of the latest emerging issues in support of the Forum's deliberations. 110 of the briefs passed the peer-review and were made available on the Forum's website.

II. Highlights of discussions at the STI Forum

A. Overview and high-level segment

6. The Forum deliberated on the role of STI in "building back" from the COVID-19 pandemic and for accelerating progress towards the SDGs, especially SDG6 on water and sanitation, SDG7 on energy, SDG9 on infrastructure and industrialization, SDG11 on sustainable cities and human settlements, and SDG17 on partnerships, which are under review at the July session of the High-Level Political Forum on Sustainable Development this year.

7. The Forum highlighted STI solutions to get the world back on track towards the SDGs, and to deal with key challenges that the world is currently facing, such as the recovery from COVID-19, the impacts of artificial intelligence, education and technology gaps, the triple planetary crisis of climate change, nature loss and pollution, as well as ongoing conflicts.

8. It also examined ways in which the world can enhance trust in science and technology, close the gender gap in STI, make digitalization more inclusive, and increase global research cooperation and funding through new partnerships. It also showcased concrete integrated technological solutions to the energy, food, water, and climate crises, and highlighted ways in which we can increase community innovations and make cities smarter, more inclusive and sustainable. The Forum directly benefitted from the ongoing work of IATT on STI4SDG roadmaps, capacity building and training, research and analysis on emerging science and technologies, and on gender and inclusivity in STI, as well as from associated initiatives such as the Global Sustainable Technology and Innovation Community (GSTIC), the Global Solutions Summit (GSS) organized by the American Society of Civil Engineers, and the STI in Africa Day Event co-organized by DESA and ECA.

9. The opening of the Forum featured statements by Ms Lachezara Stoeva, President of the Economic and Social Council, Mr. Csaba Kőrösi, President of the General Assembly, and the Secretary-General of the UN whose remarks were delivered by Ms. Maria-Francesca Spatolisano, Assistant Secretary-General for Policy Coordination and Inter-Agency Affairs of DESA.

10. Two keynote speakers set the scene for the Forum, H.E. Bonginkosi Emmanuel Nzimande, Minister of Higher Education, Science and Innovation, of the Republic of South Africa, and Professor Charlotte Watts, Chief Scientific Adviser and Director for Research and Evidence at the Foreign, Commonwealth and Development Offices, UK.

11. The Secretary-General's 10-Member-Group moderated most of the sessions. They also presented their report titled, *Science, Technology, and Innovation for the SDGs – Progress, Future vision, and Recommendations*, which provided salient background and framed the debates around specific proposals and recommendations.

12. The Forum also heard a report on the outcomes of the 26th Session of the UN Commission on Science and Technology for Development (CSTD), by its chair, Ms. Ana Cristina Amoroso das Neves, who also engaged in the Forum's deliberations on global cooperation on STI for development, in line with the theme of CSTD.

13. The Forum concluded with a discussion of opportunities and the way forward for the TFM and associated global and regional initiatives. The Forum also heard remarks on the ongoing process towards a Global Digital Compact, which is co-facilitated by H.E. Ms. Anna Karin Eneström, Ambassador and Permanent Representative of Sweden and H.E. Mr. Claver Gatete, Ambassador and Permanent Representative of Rwanda. H.E. Ms. Anna Karin Eneström delivered the remarks on behalf of both co-facilitators. Good practices and policy recommendations were identified for facilitating the development, adoption, and dissemination of sustainable technologies at a scale commensurate with the aspirations of the SDGs.

14. Selected messages and highlights of the forum are presented in the remainder of this summary.

Ministerial session on innovating to deliver the SDGs

15. A Ministerial session was held under the overall theme, *Innovating to deliver the SDGs*. The following Member States and political groups shared their experiences with STI as a central element of national development strategies, policies, and programmes: Algeria, Bangladesh, Bolivia (Plurinational State of), Brazil, China, Dominican Republic, India, Kyrgyzstan, Morocco, Oman, the Philippines, Slovenia, Tajikistan, Turkmenistan, and the USA, as well as Cuba on behalf of the Group of 77 and China. The following is a selective list of issues, challenges, and recommendations made:

16. The year 2023 is the mid-point for the achievement of the SDGs. By early 2023, only 12 percent of the SDG targets were on track (e.g. access to electricity, and child malnutrition), progress on 50% was happening but is too slow to meet the 2030 goals (e.g. quality education), and on 30% there was no progress or regression (e.g. mitigating the impact of climate change), as detailed in the SDG progress report 2023.[2]

17. If current trends continue, by 2030, 575 million people will still be in extreme poverty, 84 million children will be out of school and 300 million will be illiterate. Improved governance and resource mobilization will be needed to enhance progress and collaboration across all goals.

18. STI, including digital technologies, need to be harnessed through transformative policies, measurable commitments and high-impact initiatives for accelerated implementation of the SDGs.[3] Substantial investments are needed in key evidence-based areas, such as peace, jobs and social protection, women and girls, quality education, water and sanitation, renewable energy, biodiversity conservation, and infrastructure and digital skills to achieve universal internet access by 2030. Improved development data is also essential for targeted actions on poverty, food insecurity, climate change, health, and disaster risk management. Geospatial technologies can assist in mapping and modeling systems to support SDGs. For example, only 1 in 5 Member States have data for SDG13 on climate change, and quality of data is a major issue. Upscaling education, training, and skills development are vital.

19. Multiple initiatives have been launched to bolster STI ecosystems, including funds for technology and innovation, scholarships, and university funding support. International North-South cooperation on research and innovation remains vital. Initiatives like the BRICS R&D Center and the South-South Cooperation Center aim to encourage greener and healthier global development through international STI cooperation.

20. The STI Forum plays a vital role in addressing pandemic-related challenges and building resilience, emphasizing the role of digital technologies in SDGs, international cooperation for poverty eradication, and strengthening the science, policy, and society interface.

21. Investments are needed in digital infrastructure for e-learning, e-governance, and e-commerce platforms. An international science ecosystem should be established to provide open, reliable, and secure access to information and data. Private sector investment is key for innovation and technology development. National strategies should be aligned with SDGs and engage stakeholders in solutions design and implementation. It is important to support innovation and

[2] Progress towards the SDGs: Towards a Rescue Plan for People and Planet" A/78/80-E/2023/64.
[3] In line with preparations for the SDG Summit 2023:
https://www.un.org/en/conferences/SDGSummit2023/outcomes

research, including innovative projects in the private sector, and for transferring scientific research results to society.

22. Concrete actions, partnerships, and fresh ideas are needed for the upcoming High-Level Political Forum on Sustainable Development and the SDG Summit this year and the Summit of the Future in 2024. Empowering young scientists and fostering international networks is crucial. Multistakeholder cooperation, involving scientists, national governments, universities, communities, and civil society, is fundamental for scientific breakthroughs and the achievement of the SDGs.

B. Thematic discussions

Strengthening trust in science and technology

23. When exploring the issue of trust in science and technology, the Forum noted that the COVID-19 pandemic had demonstrated the potential of STI for addressing global challenges and that trust in science was essential for enabling swift and effective policy actions. Adequate engagement and ownership from science and engineering communities from all parts of the world, including the Global South, is key in this regard.

24. While scientific evidence is key in addressing complex global challenges, science is not a cure-all. Technological advancements can improve living conditions, but they have also often increased inequalities in certain instances, leading to increased frustration among those left behind. The scientific community needs to more effectively communicate their work and the inherent uncertainty of the scientific process.

25. STI has immense potential for advancing the SDGs. Demonstrating the positive impacts of STI on people's lives, especially those most vulnerable, can boost trust. However, trust must be earned. People need to see that technological solutions and innovations are beneficial, regulated, and accountable. At present, this is not the case in many sectors.

26. STI comes also with risks and negative impacts that need to be managed. The multilateral system can set regulatory frameworks, such as in the digital sphere, but active participation from all stakeholders is needed for developing international cybersecurity standards, AI regulations, and data governance. Capacity building is essential to ensure equal participation.

27. Fact-checking alone is not enough to counter misinformation. A better understanding of how societies can build trust in STI is needed, using cultural studies, ethics, behavioral studies, and psychology to tackle misinformation and disinformation.

28. Policymakers and regulators should openly communicate the values driving their policies and governance structures. As AI transforms various sectors, it is essential to address the potential inequalities and exclusion these new technologies may cause.

29. Partnerships are key to creating an open, fair, and trusting environment, and ensuring equitable worldwide deployment of STI infrastructures. Multisector approaches, including citizen science, dialogue with indigenous knowledge holders, and private sector partnerships, can create relevant information and enhance its uptake. Openly sharing knowledge in a respectful environment is essential for strengthening trust in science.

Integrated solutions to make progress across SDGs 6, 7, and 9

30. The Forum explored integrated solutions to the SDGs 6, 7, and 9, focusing on clean water, sanitation, affordable clean energy, and industry, innovation, and infrastructure, which are critically intertwined with human health, ecosystems, economic growth, poverty reduction, and climate change mitigation. These goals, along with others like food security (SDG2) and climate action (SDG13), are interconnected, requiring holistic, integrated solutions.

31. The climate-land-energy-water nexus exemplifies this interconnectedness. Water, energy, and land are integral to food production, which can also serve as a biofuel source. Power plants require water, while energy-intensive desalination increasingly provides water for drinking and agriculture. Climate change exacerbates these connections, with increasing droughts impacting irrigation and hydropower plants. In some regions, these impacts are already evident, necessitating integrated approaches.

32. The rapid deployment of renewable energy technologies, such as solar, wind, and hydropower is vital for achieving SDG7 and 13. Energy efficiency in industry, buildings, and transportation can significantly reduce energy use and greenhouse gas emissions.

33. Adopting sustainable agricultural practices, such as conservation agriculture, agroforestry, and organic farming, can enhance crop yields, soil health, and reduce environmental impacts. Precision farming technologies can optimize the use of inputs like water, fertilizers, and pesticides, resulting in higher productivity and lower environmental impact.

34. Water-efficient technologies can reduce water consumption in various sectors, while decentralized water systems and nature-based solutions can enhance water security and resilience to climate change.

35. Investments in climate-resilient infrastructure, like energy-efficient buildings, smart grids, flood-resistant transport systems, and the integration of green and blue infrastructure, can mitigate and adapt to climate change.

36. Sustainability gap financing is essential to support integrated solutions that, while societally beneficial, may be less profitable in strict business terms. Public and private investment in research, development, and deployment of innovative technologies can help overcome financial barriers and accelerate progress towards the SDGs. Instruments like grants, concessional loans, guarantees, and blended finance can mobilize resources for high social and environmental impact projects with lower financial returns.

Think global, act local – people and community led innovation and technology infrastructures for "smarter" and inclusive cities

37. The Forum showcased examples of people- and community-led innovation systems and of high-impact technological infrastructure systems that serve local needs while contributing to SDG actions.

38. Cities host more than half of the world's population, produce over 70 per cent of greenhouse gas emissions, and concentrate most of the expertise needed to solve global problems. Technology can support local governments in ensuring that urbanization benefits billions of people, but it is not a direct cure for all urban problems.

39. Infrastructure and technological solutions are essential for the quality of life in cities, but it is most important to focus their planning on current and future human needs, by ensuring the participation of all relevant stakeholders and engaging local communities from the design stage of technologies to their deployment

40. Urban planning and urban solutions need not only address the needs of today, but also the needs of tomorrow. It is important that local governments should maintain a longer-term perspective especially in infrastructure planning, including nature-based solutions.

41. Increased collaboration between local governments, scientific institutions and universities holds great potential. Multi-stakeholder collaboration, including between scientific institutions, private sector companies and communities, can provide new resource-efficient innovations and help tailor solutions to local needs.

42. Technological innovations can enable new, local business models that benefit from the circular economy and reduce waste, create decent jobs and support gender equality. New, innovative partnerships are needed to support small and medium-sized enterprises in research and development.

43. National governments play a key role in ensuring that local communities have the capacity and access to technological solutions they need to adapt community-specific solutions. For example, national government resources may often be needed for building digital infrastructure and creating connections to using data from earth observations, drones and artificial intelligence solutions that can then support communities and local businesses.

44. Local communities often have the crucial knowledge needed to effectively deploy nature-based solutions in urban areas. Examples include nature-based rainwater filtration systems, revitalization of abandoned areas for urban food production, green corridors for biodiversity, and natural cooling through increasing the number of green areas.

Breaking down barriers- closing the gender gap in science and technology

45. The Forum explored how to scale up progress toward sustainable development by closing the gender gap in science, technology, engineering, and mathematics (STEM) education, employment, entrepreneurship, and leadership. The debates built on the recent work of the 67th Session of the Commission on the Status of Women.

46. Without women's participation, the world loses half of its potential ingenuity. Important lessons have been learned from gender and STI initiatives that can help make innovation systems more inclusive and representative, including the scaling up of good practices.

47. While women continue to be underrepresented in STEM and in many related high-skilled positions, emerging technologies present opportunities for correcting failures of the past. There is great potential for women in the technology-driven transformation of tourism, the food system, and other critical sectors. Targeted efforts are needed for training young women to become innovators and leaders of the future.

48. An increasing number of citizen scientists[4] are women. Good practices can be replicated, for example on bridging the digital gap by creating digital spaces in schools and universities, building

[4] Citizen scientists are members of the general public who participate in and collaborate in scientific research.

sustainable cities by transferring endemic knowledge, and bridging the knowledge gap by creating bridges between universities and communities. Citizen scientists can support efforts to close the gaps in SDG achievement.

49. Women may take unconventional paths to technical work and STEM careers which should be supported by decision-makers. Peer-mentoring can empower women, and work cultures should be changed to accommodate more flexible arrangements.

50. Taking a gender-lens to public policy, goods and services, and systematic data collection on women's work in STEM could support a more human-centered and gender-balanced economy. Women need to be fully engaged already in the design stage of new technologies, so that their specific needs are addressed. New technologies also need to be gender sensitive, which necessitates technology regulations for addressing bias and discrimination in AI and other technologies.

Global research cooperation and funding – sharing knowledge through new partnerships

51. The Forum discussed means and ways of improving global research cooperation and funding. To reach the SDGs by 2030, the global community needs to address several key areas related to research and development (R&D). While the recent increase in global R&D spending is encouraging, there needs to be a rebalancing of resources to ensure more investment is directed towards the Global South, with strategies designed to enable low-income countries to participate more fully in scientific research.

52. We need to look back and appreciate the benefits of long-term commitment to fundamental research, but we also need to look ahead and anticipate challenges and possibilities.

53. Promoting international cooperation is crucial. While overall cooperation (as measured by co-authorship of research) is increasing, there remains a disparity between developed and developing countries. To maximize the impact of R&D investments, efforts to facilitate partnerships and knowledge sharing across borders should be intensified, including through support for global research networks.

54. There is a need to improve the monitoring of R&D commitments for the SDGs. Reliable, comprehensive datasets could provide valuable insights and help effective resource allocation. Furthermore, the priorities of research funders in developed and developing countries need to align more closely to the specific SDGs that need the most attention.

55. R&D donors should look to broaden their investments to cover a wider range of SDG-relevant sectors. This could involve strategies that encourage private sector investment in these areas, and mechanisms to ensure that such investment reaches the projects and regions where it is most needed.

56. Both public and private sectors play an essential role in financing R&D for the SDGs, and there needs to be a balanced strategy that leverages the strengths of both. Public funding needs to continue supporting basic research and projects with high social and environmental impact, even when these offer lower financial returns. Private funding should not only focus on areas with higher commercial potential, but also consider research areas with broader societal benefits.

57. While existing technologies and knowledge can address many SDG challenges, some areas require more focused efforts. Strengthening the entire pipeline, from fundamental to applied

science, is crucial for tackling these challenges. Better coordination of public research funders across the world, potentially through closer engagement with the UN system, could ensure that researchers and research funders play a more prominent role in achieving the SDGs.

Forging an equitable, digital future for all

58. The Forum emphasized the necessity of a fair digital future involving universal connectivity, trustworthy AI, regulatory laws, and global cooperation. Digital technology must promote equitable and sustainable development. The COVID-19 pandemic amplified the gap between the digitally connected and unconnected. The digitally equipped could innovate new remote working models during the pandemic, while those without access suffered disproportionately.

59. Digital inequality extends beyond connectivity. The divide is also between those who have the skills, technical and financial resources to utilize the internet productively, and those who do not. This results in underrepresentation and invisibility of certain groups in data-driven advanced technologies, worsening existing inequalities.

60. To ensure digital opportunities for all, including women, vulnerable groups, and those in rural areas, global and national policies must take into consideration local structures and economies. Addressing access, connectivity, infrastructure, and economic development issues is essential, necessitating increased investment in technology, public-private partnerships, and innovative financing models. However, simply providing connectivity and hardware is insufficient. People also need to be empowered with the necessary skills to leverage digital access for progress in employment and education.

61. Recognizing the challenges and risks associated with digital development is crucial, and regulations respecting human rights and laws must be implemented to ensure the benefits outweigh negative impacts. Treating data as a public good is vital to ensuring data access to all people in all countries. As it stands, a few global platforms dominate the data value chain, raising concerns about developing countries becoming mere providers of raw data that they ultimately have to buy the digital intelligence derived from their data. Capacity building and support for innovative data use is necessary.

62. On top of the connectivity divide, the emerging data divide necessitates a balanced approach to global data governance to benefit people and the planet. This includes agreement on data definitions and taxonomy, data sharing principles, and rights and principles to prevent personal data misuse.

63. The Global Digital Compact was highlighted as a potential future normative framework for equal, responsible, and ethical digitalization. The multilateral system is aptly placed to establish ground rules and procedures to ensure that the benefits from technology outweigh its risks and negative impacts. Ethical considerations around AI algorithm development and a review mechanism on achieving universal access to the internet and digital technologies were stressed.

Report of the 10-Member-Group of High-level Representatives titled, *STI for the SDGs – progress, future vision, and recommendations*

64. STI has played a pivotal role in realizing the SDGs, but global progress has been uneven and largely too slow since 2015. Rapid STI advances also threaten to worsen inequalities between and within countries. At the same time, global R&D expenditure hit a record USD2.5 trillion in 2022, and scientific knowledge and digital data have surged. Understanding and evaluating these vast

data and knowledge volumes remains challenging. And most recently, the COVID-19 pandemic has tested global STI systems, exposing both strengths and weaknesses.

65. The 10-Member-Group of High-level Representatives of Scientific Community, Private Sector and Civil Society (10-Member-Group), appointed by the UN Secretary General, presented their draft report titled, *Science, Technology, and Innovation for the SDGs – Progress, Future Vision, and Recommendations*.[5] The report helped frame the deliberations across the sessions by: drawing lessons from STI4SDG progress since 2015; outlining a future vision; and providing specific recommendations in the run-up to the SDG Summit later this year. These thematic issues are summarized in section III below.

Presentation of the Global Sustainable Development Report 2023

66. The Independent Group of Scientists (IGS) presented the findings contained in the advance unedited version of the 2023 Global Sustainable Development Report (GSDR) and discussed evidence-based solutions for the SDGs. Current trends indicate that the world is not on track to achieve the SDGs, but science-based tools can help drive change. There is an urgent need for innovative and sustainable policies, investments, technologies, and incentives for behavioral change. Capacity building at all levels is vital. The GSDR identified key interventions to drive systemic change, based on interlinkages between the SDGs. It provides frameworks for planning and implementation to achieve the SDGs, including a transformative change framework, a framework to examine entry points and agents of change, and methods to explore the SDG interlinkages. It calls for moving beyond GDP as a measure of progress and for incorporating cultural values and the value of nature. Nature-based solutions and an appreciation of cultural values are crucial for more equitable and sustainable societies.

Taking stock of STI for SDGs and looking towards the SDG Summit and the Summit of the Future

67. As the world approaches the SDG Summit in September 2023 and the Summit of the Future in 2024, it is crucial to take stock of the progress made in STI and identify high-impact policies and actions that can drive SDG progress. The recent poly-crises – the pandemic, geopolitics, conflicts, weakened multilateralism, interdependent crises of food, fuel and finance, the triple planetary crisis, and rapid advances of artificial intelligence and related technologies – have greatly exacerbated the earlier challenges of facilitating an accelerated development, deployment and sharing of key technologies of relevance for global sustainability, in order to secure better lives of current and future generations. Many of these global challenges are also driven by science and technology and by the choices we have made as societies on how to respond to them.

68. The Technology Financing Mechanism (TFM) has made significant strides in promoting science-based, solution-oriented, multi-stakeholder, and collaborative approaches to address the SDGs. It has become an unprecedented new UN entry point for science and technology communities. As envisaged by Member States that created the TFM in 2015, it has also led to an increasing number of complementary partnerships and activities spearheaded by UN Member

[5] Draft report of the Secretary-General's 10-Member-Group of High-level Representatives on "Science-Technology, and Innovation for the SDGs – Progress, Future Vision, and Recommendations", 1 May 2023, https://sdgs.un.org/sites/default/files/2023-05/10MG%20report%202023%20-draft%202023-05-01%20posted.pdf

States, the UN system, development partners, organized science and engineering communities, academics, private sector entities, NGOs, individual scientists and engineers.

69. However, there also remain significant areas for improvement of this new science-policy interface, especially in terms of effectiveness, reach, and scale, and in terms of fully coherent cooperation across the UN system.

C. Special events during the Forum

70. Four informal special events were held, including: a dialogue with the UN major group on science and technology; an innovation exhibit and the metaverse for SDGs lab on STI4SDGs roadmaps; as well as on emerging science, frontier technologies and future scenarios.

A dialogue with the UN major group on science and technology

71. The co-chairs of the UN major group on science and technology – the International Science Council and the World Federation of Engineering Organizations – organized a special event titled "*Science Technology, Innovation, and Engineering Solutions for the SDGs: Theory, Practice and Application"*. The event aimed to communicate a better understanding among different stakeholders about how science, technology, innovation, and engineering (STIE) can support SDG implementation to bolster the science-policy-society interface and improve uptake of STI solutions and knowledge. The dialogue made several key recommendations, including the following:

72. Science and technology communities need to work with a range of expertise and knowledge systems to understand the barriers that can hinder the success of technology solutions and understand how to better leverage their power to contribute to advancing sustainable development. The science and technology community can play a role in communicating and fostering engagement among such stakeholders.

73. STIE solutions are not isolated encounters between scientists, engineers and users. They require policies to support technological development, adaptation and transfer. This includes supportive patent regimes, adequate manufacturing capacities and access to necessary resources.

74. There is a need to enhance skills to deliver STIE. Investment in skills development and education infrastructure that can support national ownership and economic productivity for the next generation of the workforce is crucial.

75. STIE as an important component of ensuring peace and security. STI solutions can address many of the problems that drive social unrest, political crises, and unsustainable migration flows. In this regard, national and multilateral policy should acknowledge the organized science community includes social science and that the goal of science engagement is social cohesion.

Metaverse for SDGs lab and the innovation exhibit

76. The Forum included a special event, comprising a high-level opening ceremony for the Metaverse for SDGs lab as well as a showcase of innovations for addressing sustainability issues in local communities and beyond. The session highlighted innovations that address multiple SDGs and innovations that address the needs of vulnerable communities.

77. Young innovators shape the future world, and they must be supported and empowered. Technological innovations can help to reduce disparities and ensure benefits for all. They can

accelerate sustainability and learning. Virtual reality is helping students “learn-by-doing”, and early studies suggest these students learn faster and better retain information.

78. Scientific solutions need to be sustainable and integrate local and indigenous knowledge. Integrating new technologies with local community practices can lead to greater acceptance of these technologies and other benefits. New types of collaborations and partnerships will be necessary for driving innovation and advancing sustainability.

79. The Forum also hosted a Metaverse Lab for participants to experience virtual reality (VR) creations in person, using VR headsets. Exponential Destiny hosted the Metaverse Lab Competition to teach and mentor students on virtual reality and promote equity in access to technology. Students strived to use VR to build empathy and share experiences related to the SDGs. With the Metaverse Lab Competition, VR headsets were provided to those who could not afford them, and teams were trained through video seminars and hands-on training. The top SDGs selected by teams were quality education, gender inequality, and good health and well-being.

Implementing national STI4SDG roadmaps – capacity building and partnership in action

80. A dedicated special event was organized to discuss how the TFM can support national capacities, including through the joint work undertaken by IATT to develop and roll out STI4SDG policy frameworks, action plans and roadmaps, as well as building related capacities of policy makers. It discussed the tools, initiatives and partnerships needed for the development and implementation of roadmaps, and capacity-building.

81. STI roadmaps can enhance economic competitiveness and promote sustainable development. However, creating a thriving, accessible, and transparent innovation ecosystem involving public, business, financial, and academic stakeholders is a complex undertaking and demands an integrated approach to ensure practical, responsible, ethical, inclusive, and sustainable outcomes.

82. Many countries are off track in achieving the 2030 Agenda and the SDGs and it is important to take action to address the climate crisis, international and regional conflicts, and challenging economic conditions. To help all interested Member States in the development and implementation of STI4SDGs roadmaps, a "Partnership in Action initiative" was launched as a multi-stakeholder, informal technical group to magnify the work of the STI4SDG roadmap.

83. The global pilot programme and the Partnership in Action attest to the strength of multilateral cooperation between policy makers and scientific communities in advancing the SDGs. This model of a science-policy interface is being replicated elsewhere, for example, in six sub-Saharan African countries with support from the European Commission.

84. National representatives presented their latest advancements and shared experiences on STI for SDGs roadmaps. They highlighted the need for a suitable ecosystem to absorb technologies and innovations. The UN and its partners need to play a more significant role in coordinating financial and institutional resources and creating synergies. They also called for commitments to support STI activities through the TFM as a global public good. The 10-Member-Group proposed an international innovation ecosystem based on banks of ideas and funds for innovation to systematically identify specific problems requiring innovative solutions, advancing towards the SDGs.

85. Early resource mobilization and stakeholder engagement at local and regional levels is crucial. National entities should take ownership and commit resources for the roadmaps, and private sector involvement can help bridge the financing and innovation uptake gap.

Emerging science, frontier technologies, future scenarios, and the SDGs

86. A special event was held with a focus on scientific breakthroughs, frontier technologies, as well as lessons from future technology scenarios for the SDGs and beyond. The event engaged selected authors of science-policy briefs for the Forum, eminent scenario analysts, and key TFM partners, such as the Geneva Science and Diplomacy Anticipator (GESDA) and the Global Sustainable Technology & Innovation Community (GSTIC) partners with established processes for anticipating key STI developments and their wider impacts.

87. This year, about 300 authors from 40 countries – scientists and engineers from academia, NGOs, private sector and the UN system – submitted more than 150 science-policy briefs in response to a call for inputs in all six UN languages. 110 briefs passed the peer-review process which was organized by IATT partners.[6]

88. The Forum received a record number of briefs on biotechnology, pharmaceuticals, AI, digitalization, nanotechnology, and quantum technology. Topics ranged from biological diagnostics and cyber insecurity in medical devices, to AI applications in waste sorting and sustainable dairy production, the latest developments in green hydrogen, energy efficiency, and solar radiation modification, as well as the use of blockchain and Internet of Things (IoT) for water management. Agricultural technology, fisheries, and bioeconomy briefs covered topics like digital traceability, AI applications, and sustainable water services. Briefs also covered issues of technology ethics, open science, and gender perspectives in STI policies, as well as proposals for improving the science-policy interface.

89. A synthesis of the briefs was presented in the form of an update to the *TFM findings on the impact of rapid technological change on the achievement of the SDGs* – findings that represent a collaborative, multi-stakeholder achievement, based on cumulative learning for years.

a. All parts of the world are impacted by the latest, extremely fast progress in and applications of frontier technologies in multiple areas, highlighting the importance of rapid skills building as well as the need to use the latest digital and AI technologies to monitor and understand these rapid changes in real-time.
b. While earlier TFM findings remain valid, developments are building on increasingly interdependent infrastructures. As a result, technology divides continue to grow, even as poorer countries catch up on the basic connectivity. There are critical institutional gaps to be filled and even engineering codes and standards to be adapted to support modern innovation systems.
c. The next high-tech waves emerging from basic research labs are rapidly remaking development models. Much greater funding is needed for basic research, for university-industry collaboration, and for mission-driven innovation.
d. Entirely new products and services with new characteristics are emerging that require specific regulatory and policy solutions. Narrow AI has become ubiquitous, but billions

[6] Briefs/video presentations available on Forum website.

remain excluded from its benefits. Generative AI was made public in 2022 and has become widely used by hundreds of millions within a matter of months.

e. Rapidly advancing science and technologies have significantly changed the conditions for achieving the SDGs, compared to when they were adopted in 2015, which calls for a need to anticipate future STI-related opportunities and challenges. Scenarios/futures, roadmaps, and related capacity building are increasingly needed to make sense of the ongoing, disruptive changes.

D. Associated special events and side events

90. Two major associated events were held back-to-back with the Forum: the STI in Africa Day Event on 2 May, and the Global Solutions Summit on 5 May 2023. In addition, many side events were also organized by governments, the UN-system and stakeholders between 2 and 4 May.

STI in Africa Day Event

91. The first-ever *STI in Africa Day* was held under the theme, *STI4SDGs – Levers, Priority Areas and Actionable Steps for Africa*. It aimed at strengthening STI ecosystems in Africa in support of the SDGs with discussions focusing on mobilizing the African diaspora, empowering African youth, harnessing the African Continental Free Trade Area (AfCFTA) for STI development, and capitalizing on technological solutions for industrial diversification.

92. The event built on the outcomes of the 5th Africa Regional STI Forum, which called for scaling up investment in R&D, entrepreneurship, research infrastructure, and open science to fully benefit from the opportunities that emerging technologies present.

93. The opening session stressed the need for empowering youth and women, and for providing sustained people-centered investments to foster an innovative workforce to drive innovation, entrepreneurship, and sustainable development. H. E. Mr. Bonginkosi Nzimande, South Africa's Minister of Higher Education, Science, and Innovation, stressed the need for, and importance of, an African Research Agenda that would utilize STI to harness opportunities for Africa's development. The Deputy-Secretary-General stressed the risk of falling short on global promises and called for action to advance Africa's STI4SDGs priorities.

94. The session on Mobilizing and Engaging the Diaspora for STI in Africa proposed several policy suggestions for enabling the diaspora to contribute to Africa's development, including partnerships between universities and platforms for diaspora participation in Africa's technological and industrial development, as well as institutional capacity building.

95. The session on STI for High Productivity and Economic Diversification in Africa underlined the importance of technology access for climate resilience. Geospatial technologies were used in 37 African nations to support innovation in food and agriculture and build resilience for natural disasters. Google is investing USD1 billion in Africa to enhance digital skills and infrastructure, while Rwandan farmers demonstrated the community impact from technology transfer for mushroom farming from Juncao grass.

96. The session on the Role of Youth and the AfCFTA in STI outlined Africa's potential for transforming infrastructure and technology skills. It highlighted the need to reduce technology gaps (between men and women and/or the youth) and provide more inclusive economic opportunities. Emerging technologies and digital platforms can overcome barriers, facilitate technology transfer, and promote youth entrepreneurship. AfCFTA and youth involvement are

essential for Africa's future industrialization, with emphasis on intra-African trade, new technologies in schools, and stronger university-industry collaborations.

97. Key outcomes of the event included the announcement of the Origin Hub Initiative and the Alliance of the Entrepreneurial Universities in Africa. There was a call for additional partners to support entrepreneurship teaching and learning approaches, mentorship for student entrepreneurs, design of exchange programs, and assistance for local institutions.

98. In addition, the launch of the STI for Africa Coalition marked an important step towards mobilizing global support for Africa's STI and development. Co-leads include Ethiopia, Ghana, Morocco, and South Africa. The Coalition aims to mobilize diaspora talent and investment, promote awareness of STI opportunities in Africa, and advance Africa's STI interests within UN processes and to accelerate the SDGs.

Global Solutions Summit

99. The Global Solutions Summit (GSS) was held in collaboration with UN DESA, the World Federation of Engineering Organizations, and the American Society of Civil Engineers. The theme was, *Leveraging the Diaspora, Youth, and the African Continental Free Trade Area (AfCFTA) to harness STI for the SDGs*.

100. The event looked at why game-changing technologies remain underused in Africa and how the continent could leverage the Diaspora, youth, engineering know-how, the private sector, and the AfCFTA to transfer these technologies to where they are needed. Successfully addressing this challenge could usher Africa and other developing regions into a new era of sustainable, inclusive growth, as demonstrated by examples of smart cities, smart agriculture, and smart factories.

101. The event also highlighted the importance of STI4SDG roadmaps for SDG progress. These roadmaps need to be dynamic, agile, and adaptive, specifying goals, milestones, gaps and barriers, action items, and priorities with timelines. Effective roadmaps must incorporate a wider range of concerns, stakeholders, and issues, many of which extend beyond the realm of science and scientists. Topics such as promoting mission-oriented research, mobilizing the engineering capacity, involving the diaspora in technology scouting and deployment, and building institutional capacity for technology evaluation were also addressed.

Side events

102. Side events provided an additional significant opportunity for governments and other stakeholders to participate in the Forum. 48 side events were organized by TFM partners, including 20 in-person events at UN headquarters, two in-person events across New York City, and 26 virtual events. Organizers included a mix of Member States, UN system, intergovernmental organizations, academia, organized science and engineering communities and a range of civil society and private sector stakeholders: the Governments of Belgium, Brazil, Canada, Finland, Indonesia, Israel, Germany, Luxemburg, Niger, Dominican Republic, Slovenia, South Africa, and the United Kingdom; Group of Friends on Climate Action (co-chaired by Morocco and France); International Seabed Authority; African Union Commission; FAO and World Food Forum; UN ECE, UN Global Pulse; UN Innovation Network; UN EOSG; UN-Habitat; UN Technology Bank for LDCs; UN ECA; UNCTAD; UN DESA; ITU; UNIDO; UNDP/UNOSSC and UNDP India; WHO; WFP; WIPO; UNWTO; Dag Hammarskjöld Library; Office of the Special Adviser on Africa; UNESCO International Institute for Higher Education; and UNESCO regional offices for East Asia and for

Southern Africa; UNITAR; UNICEF Child Friendly Cities Initiative; Global Research Council; International Federation of Library Associations and Institutions; World Federation of Engineering Organizations; Universities Consortium of Small Island States; US National Academies of Sciences, Engineering, and Medicine; Chinese Academy of Sciences; Global Energy Interconnection Development and Cooperation Organization; Global Sustainable Technology & Innovation Community (G-STIC); Science and Technology Policy Institute (STEPI) Republic of Korea; Engineering for Change; International Research Center of Big Data for Sustainable Development Goals; International Society for Digital Earth; International Centre on Space Technologies for Natural and Cultural Heritage under the auspices of UNESCO; CAS-TWAS Centre of Excellence on Space Technology for Disaster Mitigation; Technology and Management Centre for Development of the University of Oxford; Universidade Federal Da Paraiba; Universidade Federal de Pernambuco; DePaul University; AI for the Planet Alliance; European Council on Foreign Relations; SBK Foundation; 3 ideas; The Broadband Commission for Sustainable Development; the Global Partnerships Forum; Carnegie Climate Governance Initiative; IAAI GloCha (International Association for the Advancement of Innovative Approaches to Global Challenges); Wildlife Conservation Society; Lord Aeck Sargent; HABITAT Coalition; Citizen Outreach Coalition; iCure Health; Intercontinental Network for the Promotion of the Social Solidarity Economy (RIPESS); Women's Health and Education Center (WHEC); Science-Innovation Institute of Sustainable Development in Shenzhen; Science Technology Engineering & Innovation Policy Asia and the Pacific Network (STEPAN); and the Science-Policy Interface Platform of the UN Major Group for Children and Youth.

III. Recommendations for consideration

103. The Forum highlighted many practical examples and proposed recommendations for action by Governments, the UN system, scientists, academia, civil society, and the private sector. The following may be considered by decision makers, in addition to the wider range of issues outlined in section II.

A. General recommendations

104. The COVID-19 pandemic has demonstrated the great potential of human ingenuity for addressing complex global challenges. But it has also showcased how public trust in science is an essential basis for swift and effective policy actions. Tools such as scientific advisory committees should be used to build trust in technology, supported by substantial investment in education and capacity building, infrastructure, and policy frameworks that prioritize transparency, privacy, and security. More open communication is needed about the role of science in societies.

105. Innovation is critical to achieving the SDGs, and young innovators' contributions are essential. Scientific solutions need to be sustainable and must integrate local and indigenous knowledge. Women and girls need to be empowered around science, including by closing the gender gap and ensuring women’s full participation at all levels.

106. Concrete solutions need to be identified for overcoming technology deployment challenges. Local governments need to be empowered and community-led initiatives are critical to help reducing disparities. Technologies and institutions co-evolve, with progress in one area limiting progress in the other. Communities as users tend to know best what type of institutions are needed.

107. Public research funders need to better coordinate their activities across the world. They should consider working closely with the UN system. Looking beyond 2030, researchers and research funders could play a much more prominent role.

108. Benefits of digital technologies are currently reaped by too few, causing frustration and mistrust. Technology can bring great hope and it contains a promise for tackling our challenges from climate change, food insecurity and degradation of the environment. However, to ensure that their benefits outweigh the negative potential of new technologies, appropriate rules and regulations are required at all levels.

109. Rapid adoption of AI applications, most recently including generative AI, highlights their usefulness, including in the healthcare sector, with other sectors to follow. Policy makers need to anticipate these changes and be explicit about addressing the inequalities and exclusion that may be caused by them.

110. International STI cooperation, multi-stakeholder partnerships, and engagement with communities and the wider public essential.

111. The multilateral system is uniquely placed to set norms and guidance on a number of spheres of technology and innovation, in line with existing human rights standards. Active participation of all stakeholders is needed for developing international cyber security standards, use of genetic material, AI regulations and data governance, with required capacity building so that all actors can equally participate in the conversations.

B. Recommendations by the 10-Member-Group of High-level Representatives

112. At the mid-term of the SDGs, high impact actions are needed on STI for the SDGs. In its report[7], the 10-Member-Group identified the following proposals and recommendations for high-impact policies and initiatives towards their vision for STI in 2030, which deserve serious consideration: (a) Sustainability Science and Technology Cooperation Package for Future Generations; (b) Building the next generation Web 3.0 distributed system for all by 2027; (c) Capacity building on generative AI for the SDGs; (d) One-UN programme on digitalization; (e) Global carbon dioxide removal (CDR) fund and market; and (f) Funding global public goods.

- Recommendation 1: Global governmental research funders to boost spending on SDGs by 20% over the next five years
- Recommendation 2: USD1 billion per year for a collaborative, global sustainability science centre and training network across geopolitical divides (with demonstration projects at scale in energy, food, climate, biodiversity, health, and sanitation)
- Recommendation 3: Global network of banks of ideas, funds for innovation, and ethical councils for innovation
- Recommendation 4: Develop and implement national STI4SDG roadmaps, as strategic guideposts for all stakeholders
- Recommendation 5: Prioritize investing in the first 1,000 days of a child's life particularly in the poorest settings within and between countries (providing modern medical and nutritional support for all children before 2030)

[7] Draft report of the Secretary-General's 10-Member-Group of High-level Representatives on "Science-Technology, and Innovation for the SDGs – Progress, Future Vision, and Recommendations", 1 May 2023, https://sdgs.un.org/sites/default/files/2023-05/10MG%20report%202023%20-draft%202023-05-01%20posted.pdf

- Recommendation 6: Share technologies and skills to solve the basic health issues of water, sanitation, and food security.
- Recommendation 7: Governments to commit to put in place policies, regulations, initiatives, and funding to build the next generation Web 3.0 distributed system and make it work for all by 2027.
- Recommendation 8: Build worldwide capacity for using, developing, and understanding the impacts of generative AI.
- Recommendation 9: Create a One-UN programme on digitalisation and sustainability in support of developing countries.
- Recommendation 10: Create a global carbon dioxide removal (CDR) fund and market to facilitate the sustainable deployment of CDR technology options.
- Recommendation 11: Boost global public investment in global public goods to reach (0.2% of GNI) and consider implementing the recommendations of the Expert Working Group on Global Public Investment.

C. Recommendations for the Technology Facilitation Mechanism

113. The Mechanism has made significant strides in promoting science-based, solution-oriented, multi-stakeholder, and collaborative approaches to support SDG implementation. It has become an unprecedented new UN entry point for science and technology communities and has led to many complementary multi-stakeholder partnerships and actions. However, significantly more resources are needed to support the Mechanism for it to be commensurate with the ambitions of the 2030 Agenda for Sustainable Development.

114. The IATT continues to serve as an effective collaborative tool, despite the chronic lack of funding for its activities. Each participating UN entity contributes to the work of the IATT within its existing resources and based primarily on volunteer work. Despite these challenges, the IATT has supported collaboration and enhanced partnerships on STI4SDG roadmaps, emerging science and technologies, capacity building, and gender equality in STI, among other topics. The IATT should be strengthened and adequately resourced. It should further enhance its outreach efforts to ensure that Member States are fully informed of the benefits that the IATT provides. This includes sharing more widely information about foundational, open capacity building activities on STI as well as targeted support to Member States, within the budgetary constraints.

115. The Secretary-General's 10-Member-Group of High-level Representatives serves as an active and engaged part of the TFM and has produced a report that contains several actionable recommendations which can provide inputs for deliberations on STI-related UN processes and initiatives. Its role in providing scientific and technological advice and in engaging expert communities should be strengthened and adequately resourced.

116. The STI in Africa Day Event broke ground by providing space for in-depth discussions of regional STI issues. The STI for Africa Coalition, which was launched at the Event, should promote awareness for STI in Africa and facilitate advancing Africa's STI within a range of UN processes.

117. In collaboration with the respective UN Regional Commissions, similar deep-dive events for other regions could be considered for future Forums. Closer institutional links are also needed with key STI forums and other processes, including with CSTD, the FAO Science and Innovation Forum, GSTIC, GSS, and others. The TFM Secretariat could consider maintaining a pool of TFM

partners, experts, and resources to support matchmaking of demand and supply of technology expertise.