2018 STI Forum Briefing Note

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Summary of the Third Annual Multi-Stakeholder Forum on Science, Technology and Innovation for the Sustainable Development Goals: 5-6 June 2018

The third annual meeting of the Multi-stakeholder Forum on Science, Technology and Innovation for the Sustainable Development Goals (SDGs)—STI Forum—took place at UN Headquarters in New York on 5-6 June 2018. The theme for the Forum was "Transformation towards sustainable and resilient societies." In addition to ten substantive panel discussions, the STI Forum also featured a series of 90-second innovation pitches selected from numerous submissions for the sharing of innovations that provide solutions targeted to the SDGs under discussion:

- Sustainable management of water and sanitation for all (SDG 6)
- Access to affordable, reliable, sustainable and modern energy for all (SDG 7)
- Inclusive, safe, resilient and sustainable cities and human settlements (SDG 11)
- Sustainable consumption and production patterns (SDG 12)
- Sustainable terrestrial ecosystems (SDG 15)

The STI Forum is a component of the Technology Facilitation Mechanism (TFM) outlined in the Addis Ababa Action Agenda (AAAA) and the 2030 Agenda for Sustainable Development. The TFM also includes an Inter-Agency Task Team on STI for SDGs (IATT), a 10-Member Group, and an online platform.

The IATT is comprised of several UN agencies, and co-chaired by the UN Department of Economic and Social Affairs (UN DESA) and the UN Environment Programme. The 10-Member Group was established in January 2016 to work with the IATT to prepare for the STI Forum, and develop and operationalize the TFM's online platform, among other tasks. Its co-chairs for 2018-2019 are Vaughan Turekian, Senior Director at the National Academies of Sciences, Engineering, and Medicine, US, and Agnes Lawrence Kijazi Director General, Tanzania Meteorological Agency. The online platform is a gateway for information on existing STI initiatives, mechanisms and programmes.

The TFM was officially launched in UN General Assembly resolution 70/1 in September 2015, which calls on the President of the UN Economic and Social Council (ECOSOC) to convene the STI Forum once a year to discuss cooperation on STI around thematic areas for the implementation of the SDGs. The Co-Chairs of the 2018 STI Forum, appointed by ECOSOC

President Marie Chatardová, are Amb. Toshiya Hoshino, Deputy Permanent Representative of Japan to the UN, and Amb. Juan Sandoval Mendiolea, Deputy Permanent Representative of Mexico to the UN.

Welcome address and opening: Appreciating the cross-cutting nature of science, technology and innovation

Opening the meeting on Tuesday morning, ECOSOC President Marie Chatardová noted that technology is changing the trajectory of development. She said the question is how can technologies help connect with and address the vulnerabilities of those most left behind. She also highlighted the potential of technology to bridge sectoral and institutional silos, which she said is essential for achieving the SDGs.

Maria Luiza Ribeiro Viotti, Chef de Cabinet for the UN Secretary-General, said new technologies, including artificial intelligence, biotechnology, and robotics, will generate new solutions to SDG implementation. She noted that the Secretary-General aims to strengthen the UN system to better engage with these new technologies and, to this end, this strategy on technology for the UN system is focused on promoting partnerships and increasing transparency.

Liu Zhenmin, UN Under-Secretary-General for Economic and Social Affairs, noted that UN entities are working together to support the TFM. He recalled the role of the STI Forum as a convener of a variety of relevant stakeholders, which plays a key role in advancing the use of technologies for good. He said the TFM online platform will serve as a gateway for existing STI initiatives and programmes. Zhenmin explained that the platform will connect those needing solutions with those who have them. He added that the STI Forum has received more applications for innovation pitches for achieving the SDGs than in previous years.

Keynote Presentations: Andrew Keen, author of *The Internet is Not the Answer* and *How to Fix the Future*, said that the digital revolution was supposed to reflect shared global values and improve the world through a commitment to equality, jobs, civic and civil engagement, and the right to privacy and sanctity of self. But this isn't working out, he argued, it is doing the reverse. He called for greater regulation of companies and data privacy to "fix the future," adding that the UN is the right place to begin this conversation.

Noriko Arai, Professor, Japan National Institute of Informatics, highlighted the benefits of the knowledge-based society that has allowed people to access free learning materials and enabled rural women to start small businesses and sell products anywhere. But

there is a dark side, she added, highlighting that the wealthiest 1% now own more than half of the world's wealth. This is partly due to the digital ecosystem, she said, noting that giant tech platforms harvest people's data and sell it in exchange for "free" services. She added the rise of artificial intelligence (AI) and the Internet of Things will only accelerate this process.

Eric Garcetti, Mayor of Los Angeles, via video, said that Los Angeles is incubating the next generation of clean technology companies and is now the #1 solar city in America. Without a commitment at the national level, he spearheaded a network of over 400 mayors to implement the Paris Agreement on climate change. The SDGs are not just about diplomacy, he added, "We know in LA they are about us and we need to cooperate as one world united in common cause and purpose since our work is just beginning."

Arun Sundararajan, New York University, said AI and cyberwar will extend their range in real territories. He noted that it is not pragmatic to try to regulate online platforms, which will increasingly mediate people's relation with markets, but we need to negotiate with them as with institutions. He emphasized that we need to start a democratization of these platforms and ask them to come with a clear, simple set of principles and take a positive role in society.

Opening Remarks: Egypt, for the Group of 77 and China, expressed concern about the continual and widening technology and digital divide, not only between people in countries, but between developed and developing countries as well. To address this gap, he called for encouraging the development, transfer, and diffusion of technologies to developing countries on concessional and preferential terms. He also emphasized the need to make the TFM online platform operational as soon as possible.

Bangladesh, for the Least Developed Countries (LDCs), noted that four in five people in LDCs now have access to mobile phones. In spite of LDCs governments' efforts to expand internet access, he said, internet access depends on a few major companies in the developed world, and LDCs lack the needed infrastructure to attract them. He stressed that access to information and communications technologies and the internet is essential to graduate from LDC status and not to relapse after graduation. He expressed hope that the Technology Bank for LDCs inaugurated on 4 June 2018 will provide the LDCs with the support they need.

Session 1: Impact of rapid technological change on the achievement of the Sustainable Development Goals

In introducing this session, STI Forum Co-Chair Juan Sandoval said that this session would focus on the impact of rapid technological change on the achievement of the SDGs, including cases where changes may occur at an exponential pace.

Elliott Harris, Chief Economist and Assistant Secretary-General for Economic Development, presented some of the IATT's initial findings on the impact of rapid technological change on the achievement of the SDGs. He said that the benefits of digital technologies, robotics, AI, biotechnology, and nanotechnology are so great that we cannot afford not to use them, but there can be potential negative impacts. He noted that declining costs for automated production can lower the demand for workers with certain skills and countries may need to find new kinds of development pathways that incorporate these technologies, while matching skills to the evolving needs of job

markets. He noted the environmental costs of technology, adding that the electricity demand for cryptocurrency mining equals the electricity use of the Czech Republic.

Peter Major, Vice-Chair of the 21st session of the Commission on Science and Technology for Development (CSTD), said that the CSTD focused on the positive implications of big data to fight typhoid in Uganda and help farmers respond to food security and drought in India and other countries. He called for linking traditional knowledge with modern science, as well as examining ethical challenges and bridging the digital gap. He noted that the UN Conference on Trade and Development (UNCTAD) and China will organize capacity-building workshops later in 2018 focusing on STI policy and technology incubator development.

Panel Moderator Miguel Ruíz Cabañas, Undersecretary for Multilateral Affairs and Human Rights, Ministry of Foreign Affairs, Mexico, explained how his government analyzed the relationship between AI and the impact of technology on achieving the SDGs. He called for the UN to collect and analyze information and develop best practices and exchange of information so governments can utilize technological change and AI while minimizing risks.

Sarah Al Amiri, Minister of State for Advanced Sciences, United Arab Emirates (UAE), noted that, given that UAE's richest resource, oil, could reach the end of demand in 2050, the UAE aims to capitalize on STI to find ways to continue the development of key sectors of the economy. She stressed that "science has and will always save humanity." She observed that, in order to achieve the SDGs, we will need to capture the data from ongoing experiments—beyond big data we will need access to data from other complex projects.

Thomas Philbeck, Head of Science and Technology Studies, World Economic Forum, invited reflection on how the scale and scope of technologies expose our vulnerabilities—both the dangerous and positive ones. At the same time, he observed, technologies cast light also on middle grounds that might not be easily observable, like common goods, where action has the potential to be instrumental. Stressing that "the way we talk about technology matters," he asked for caution when using language that might lock us in dangerous narratives, either being scared or worshipping technology.

Göran Marby, President and CEO of the Internet Corporation for Assigned Names and Numbers (ICANN), highlighted that it is the end users who decided that they needed the internet, thus the internet is essentially driven by the needs of end users. Noting the importance of local systems and communities, he said ICANN develops scripts that allow people to use their own languages to search on the internet without needing to know English.

In the subsequent discussion, Turkey announced that the STI Bank for LDCs, hosted by Turkey, was inaugurated on Monday, 4 June 2018. This Bank will strengthen the capacity of LDCs to scale-up and deploy technology and innovation, and strengthen partnerships between governments, the private sector and other stakeholders. The US called for a focus on the opportunities of new technologies, noting that over-emphasizing the negative narratives of highly beneficial tools could deepen existing divides.

South Africa said it is creating a South African SDG Hub to disseminate existing research and information. Brazil called for addressing inequalities caused by the digital divide. A stakeholder called for the use of analytics and technologies to drive better

technology adoption. Another stakeholder noted the massive amounts of electricity and minerals used and e-waste and greenhouse gases produced by online activity.

In response, Al Amiri said giving access to technologies to developing countries and analyzing lessons learned should benefit each nation. Philbeck said as we go forward we need to strategically consider and develop governance in line with societal values. Marby noted that legislative efforts to get away from what is bad on the internet risks harm to what is good. In summarizing the panel, Moderator Ruíz Cabañas said that not everyone agrees on every point but they agree on "education, education, education!"

Session 2: Interactive Dialogue with the 10-Member Group to support the Technology Facilitation Mechanism

Moderator George Essegby, Director, Science and Technology Policy Research Institute, Ghana, said that this session will enable the 10-Member Group to introduce themselves individually and interact with the audience. He noted that two members of the 10-Member Group, Heide Hackmann, Executive Director, International Council for Science, South Africa, and Ada Yonath, Director and Nobel Laureate, the Helen and Milton A. Kimmelman Center for Biomolecular Structure and Assembly of the Weizmann Institute of Science, Israel, were unable to attend the Forum, and invited the other eight members to engage with the audience.

10-Member Group Co-Chair Agnes Lawrence Kijazi pointed out that not all technologies currently available globally can be applied to developing countries due to developing countries' different capacities. 10-Member Group Co-Chair Vaughan Turekian noted that the value of the STI Forum comes from bringing together the variety of expertise in technology existing outside governments.

Paulo Ernani Gadelha Vieira, Coordinator of the FIOCRUZ Strategy for the 2030 Agenda, Oswaldo Cruz Foundation (FIOCRUZ), Brazil, highlighted the added value that multi-stakeholder cooperation can bring to advancing progress towards addressing humanity's challenges.

Huadong Guo, Chair of Academic Committee, Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences, emphasized the potential of big data to contribute to achieving the SDGs.

José Ramón López-Portillo Romano, Chairman, Q Element Ltd., Mexico, said the 10-Member Group will pay attention to the socio-economic consequences of the rapid technology changes.

Michiharu Nakamura, Senior Advisor (Former President), Japan Science and Technology Agency, stressed that technological progress cannot be achieved without economic and social progress, thus comprehensive STI roadmaps and multi-stakeholder partnerships are needed.

Anne-Christine Ritschkoff, Senior Advisor VTT Technical Research Centre of Finland Ltd., emphasized the innovation enabled by the cross-pollination between different technologies.

Špela Stres, Head of Innovation and Technology Transfer Center for Jožef Stefan Institute, Slovenia, brought up the importance of STI to supporting indicators for the SDGs.

In the subsequent discussion, stakeholders noted the need to value existing knowledge and indigenous knowledge and include broad voices in fora such as the STI Forum. Another asked how technology can help humans live in harmony with nature. A third noted the establishment of an SDG Market in Israel that is an online platform to bring funding to technology projects that will implement the SDGs.

In conclusion, 10-Member Group Co-Chair Turekian said that this is an ongoing dialogue with civil society for civil society, and highlighted the importance of indigenous and existing knowledge.

Session 3: STI for sustainable management of water and sanitation for all (SDG 6)

Co-Chair Sandoval opened the session on the status of existing knowledge for sustainability and progress for STI to contribute to achieving SDG 6.

Innovation Pitches: Sreekumar Thaliyil Veedu, Technorbital Drinking Water Systems, described their water purification system that lasts for two-three years and can purify 8000 liters of water at 0.03 cents per liter at home or when travelling. They want to expand to reach two billion people who do not have access to clean drinking water.

Dexter Gauntlett, SweetSense Remote Water Monitoring Platform, described their remote monitoring system to monitor water points around the world to ensure broken water pumps are quickly repaired. Currently serving five million people in East Africa, they want to expand their presence.

Sydney Gray, Mama Maji, described their work with 270 women to bring water to over 4000 people in four counties in Kenya by building rain tanks. These women build them and sell them to the community at half the price of the competition and will increase water storage by 840,000 liters.

Panel Presentations: Moderator Špela Stres, 10-Member Group, noted that 1.6 billion people had to travel for at least 30 minutes in 2015 to get access to water. She stressed that access to water, sanitation and hygiene (WASH) also remains a challenge.

Katalin Bogyay, Permanent Representative of Hungary to the UN, cautioned that humanity is currently facing the risk of suffering a 40% shortage of water by 2030. She called for an integrated approach to water management and for mainstreaming WASH in all sectors. Bogyay highlighted the importance of multi-stakeholder partnerships to address the water challenges that the world faces.

Charlotte Watts, Chief Scientific Advisor, UK, said the UK is investing in research and development to find solutions to: gathering better data on water sources; helping developing countries leapfrog water challenges; and better predicting extreme weather events to enable countries to plan for resilience.

Ernesto Rodriguez Leal, Rotoplas, Mexico, said technology is "out there and ready" to help tackle the SDG 6 challenges, but the problem is that the mindsets of industry, academia, and governments are different. He invited reflection on how common ground can be found and explored to promote open innovation to capitalize on technological advancements for sustainable development.

In the discussion that followed, Colombia described how her country has improved access to drinking water and wastewater treatment as well as progress in water purification, decontamination of rivers, and bringing water to rural areas. A representative of the business sector advocated for stronger

emphasis on nature-based systems and the value of ecosystem services. Algeria noted that development of new technologies is a prerequisite for sustainable development.

In response, Watts said that learning from nature and how we have weakened natural systems is an important part with regard to water. Rodriguez noted that more than 20,000 people will benefit from rainwater harvesting and 250,000 have access to water purification systems, while almost 6.5 million cubic meters of wastewater has been treated. He added that if we follow the route of previous generations we will not have access to water.

Session 4: STI for sustainable consumption and production patterns (SDG 12)

Co-Chair Hoshino opened the session to discuss the status of existing knowledge and technology, and explored the potential for how STI can support the achievement of SDG 12 on sustainable consumption and production (SCP).

Innovation Pitches: Gerald Marin, FoPo Food Powder, Philippines, described how his company collects ugly fruits and vegetables, dries them, and turns them into powder that has a two-year shelf life. Companies can use the powder to create their own food products and FoPo is also ideal for humanitarian aid purposes.

Marian Van Noppen and Fred Geyer, Inga Foundation, presented their organic farming system that eliminates the need for slash and burn agriculture in the tropics. They use a system where farmers in these communities train other farmers and the Alley-Cropping for Sustainability programme provides seeds and crops to start the process.

Panel Presentations: Moderator Anne-Christine Ritschkoff, 10-Member Group, spoke of the role of technology in driving resource efficiency and thus SCP.

Shenggen Fan, Director General, International Food Policy Research Institute (IFPRI), said under usual technologies, beef and other ruminants account for 20 more times the land use and greenhouse gas emissions than pulses per unit of protein consumed. He called for support of "multiple-win" technological innovations, such as: yield enhancing technologies (remote sensing, precision agriculture); improved, climate-resilient varieties (cross-bred soybeans, heat tolerant wheat); and new transformative technologies (alternative proteins, gene editing).

Erika Kraemer-Mbula, University of Johannesburg, South Africa, stressed that for SDGs to succeed, they need to succeed in Africa. She noted that Africa is estimated to double its population by 2050 and will have the world's largest work force, comprised especially from youth. Microenterprises will thus be vital to employment, she said, and technological innovation anchored in local capabilities will be essential for sustainable development. She called for thinking beyond education to learning systems that blend different types of science.

Marco van der Ree, Climate-KIC, said that with regard to climate change, Europe is not on track, thus incremental change is not an option—we need to leapfrog. He said Climate-KIC invests in systemic innovation in four areas: urban transitions; sustainable production systems; sustainable land use; and decision metrics and finance. He called for thinking of systemic innovation that takes a "whole-system approach" by building packages of solutions and addressing blockages to change.

Arun Sundararajan, New York University and author of *The Sharing Economy*, explained how new technologies are creating a new economic model focused on shared-access consumption and crowd-based capitalism. They also increase the efficiency of the existing economic model, he said, through crowd-based incentives (for consumption) and blockchain (for production). He identified as key challenges: access to technology and process knowledge; incremental versus "big-bang" systemic change; and basic technological and business literacy.

In the discussion that followed, Rockefeller University described efforts taken to improve water and energy conservation and waste reduction, which is a model for transforming scientific and medical facilities. The Major Group for Children and Youth stressed the need to shift from economic models that value growth for growth's sake. He called for assessments on extractive industries and ensuring that skills match technological innovations to ensure future work and jobs for youth. Madagascar described its initiative on urban agriculture that contributes to the fight against poverty, creates jobs, fights malnutrition, contributes to greener cities, and fosters sustainable consumption. In closing, Ritschkoff said youth is the answer for a sustainable future and although we have many challenges, science and technology can provide solutions.

Session 5: STI for sustainable terrestrial ecosystems (SDG 15)

Co-Chair Hoshino introduced this session on the potential for STI to support the achievement of SDG 15 on sustainable terrestrial ecosystems.

Panel Presentations: Huadong Guo, 10-Member Group, moderated the panel.

Inger Elisabeth Måren, University of Bergen, Norway, noted that humans modified 40% of the Earth's surface mostly for food production. Contrary to the general view, most of the calories currently consumed are produced by small-scale farmers and their surrounding ecosystems. She called for more biodiversity-friendly food-production systems and making the distinction between land use and land abuse. This can be done, she said, through including externalities in prices and regulations.

Skumsa Kathleen Audrey Mancotywa, Department of Environmental Affairs, South Africa, noted that Africa's STI infrastructure, even though improving, is still weak. She called for solutions to poaching and illegal wildlife trafficking. South Africa has been working with the mining sector on the Mining Biodiversity Guidelines, she said, which were developed with the help of biodiversity conservation tools.

Didier Babin, Chair of the International Coordinating Council of the UNESCO Man and the Biosphere Programme, stressed that sustainable development is not an option but an obligation. He called for caution with the "tension areas" within the SDGs, where certain SDG targets pose threats to biodiversity.

Suresh Nair, International Centre for Genetic Engineering and Biotechnology, India, said the solution for tackling the challenges posed by the decrease in arable land, paired with the pressure to use less pesticides and the urgent need to increase food productivity, is host-based resistance. By using plants' natural resistance, he noted that we can produce more in terms of crop yield, and thus decrease pressure to convert forestland into farmland and prevent biodiversity loss. To that end, he

recommended carrying out vigorous screening of crop germplasm to identify appropriate resistance against major pests and devise molecular tools to get a better understanding of insect pests.

In the subsequent discussion, a stakeholder asked about gene cultivation versus genetic engineering and associated risks to humans. Yale University described a programme called "Editing Nature," which is developing biotechnology to limit invasive species and protect endangered species. She called for involvement of local and traditional knowledge and historically marginalized communities. UNESCO highlighted the role of biosphere reserves in creating livelihoods while reversing the decline in biodiversity and benefitting from local and indigenous knowledge.

In response, Måren said it is naïve to think we can continue eating and producing food like we do today in the future and we need to restructure our food system. Mancotywa called for all sectors to work together to combat biodiversity loss, drought, and desertification and ensure ecosystems are resilient to climate change. Babin said we need to take scientific and technological risks seriously, but biodiversity and ecosystems are essential for prosperity. Nair said we need to transfer technology to the grassroots level for immediate implementation.

Session 6: National STI roadmaps for the SDGs and capacity building

Co-Chair Hoshino opened the session Wednesday morning explaining that the focus is on STI roadmaps, policies and related capacity-building needs in the context of the SDGs, as seen from a range of country perspectives.

Moderator William Colglazier, Center for Science Diplomacy, American Association for the Advancement of Science, said that roadmaps are most effective when built with stakeholder input and updated as new information becomes available. STI for SDG roadmaps should be developed to achieve all the SDGs and Member States can lead the way and develop their own roadmaps and report to the High-level Political Forum on Sustainable Development (HLPF) in 2019.

Patricia Appiagyei, Deputy Minister for Environment, Science, Technology and Innovation, Ghana, said Ghana's STI roadmap ensures that technology drives the implementation of national policies and programmes. She noted that the government established a National Research Fund, which will receive 1% of Ghana's gross domestic product each year.

Teruo Kishi, Science and Technology Advisor to the Minister for Foreign Affairs, Japan, spoke about the benefits that STI brings to the SDGs, such as breakthroughs in nutrient use efficiency for rice in Africa obtained through genetic improvement and fertility sensing techniques. STI roadmaps need to serve as communication tools for organizing knowledge, he said. He called for: solutions enabled by global data; cross-sectoral collaboration; and fostering human resources for "STI for SDGs."

Aisha Jones, Director of Research, National Commission on Science and Technology, Jamaica, said STI will be mainstreamed in Jamaica's "Vision 2030" through a participatory approach. She underscored the need for: international cooperation for capacity building; dissolving institutional and sectoral silos; and focusing on areas of competitive and comparative advantage.

Mahmoud Mohieldin, Senior Vice President for the 2030 Development Agenda, World Bank Group, explained that STI roadmaps serve as a practical foundational building block for policy makers, the private sector, civil society, and development partners, helping integrate STI into national development plans and budgets. He said the World Bank will harness STI in all sectors and client countries by leveraging public-private partnerships to: develop the foundation for sustainable, technology-led economies; expand the capacity of people and institutions to thrive in a society resilient in face of disruption; and harness disruptive technology, data, and expertise to solve development challenges and manage risks.

In the subsequent discussion, Georgia described its strategic development programme, which is adjusting the SDGs to the needs of Georgia, including reforming the financing system for higher education, improving international collaboration on research, and the National Innovation Ecosystem Project. Chile described the work underway to improve scientific and technological capacities to achieve the SDGs, especially in the areas of sustainable water management and natural disaster resilience. Japan said that every country should develop an STI roadmap for each SDG to ensure no one is left behind.

The University of Lapland said it is important to ensure STI roadmaps have balanced access and equal opportunities, a strong media and communication plan to support implementation, and sufficient resources that can create benefits for all stakeholders. The OECD described its experience in helping develop national STI roadmaps and stressed the importance of gender quality. He added that we cannot risk under-investing in global public goods.

In response, Appiagyei said that developing countries need political stability so there is a good policy space to implement these ideas. Kishi said roadmaps should be flexible and ambitious. Jones looked forward to stronger collaboration and multi-stakeholder cooperation among Member States, including regional policies and efforts for implementing national development goals and the SDGs. Mohieldin said the World Bank needs to do more with the public sector and include more women and girls, as well as do more work in fragile and post-conflict situations.

Session 7: Realizing the full potential of local and indigenous knowledge, and homegrown innovations for the achievement of the SDGs

Co-Chair Hoshino explained this session will discuss what is currently known about how local and indigenous knowledge contributes to the SDGs, and how indigenous peoples and local communities can build synergies between their knowledge systems and that of science to achieve the SDGs.

Co-Moderator Paulo Gadelha, 10-Member Group, said that indigenous and local knowledge is a lively and important body of knowledge that is important for resilience, bringing innovative solutions to the key questions of the SDGs. Co-Moderator Myrna Cunningham, President, Center for Autonomy and Development of Indigenous Peoples, said the aim is to acknowledge that these systems of knowledge, which have existed for many centuries, can create synergies with other systems of knowledge to help implement the SDGs, adding that the panel will seek to build bridges between these different systems of knowledge.

Minnie Degawan, Director, Indigenous and Traditional Peoples Programme, Conservation International, said "traditional knowledge" is often misunderstood and underutilized but the traditional knowledge of indigenous peoples has sustained us for generations as it had been acquired through years and years of interactions with the land. Noting that traditional knowledge is a specific knowledge system, not higher or lower than the Western knowledge system, she called for indigenous peoples to be supported to participate in the STI Forum.

Joel Heath, Executive Director, The Arctic Eider Society, Sanikiluaq, Canada, said the three pillars of the Arctic Elder Society are: research, by enhancing capacity for self-determination and the role of indigenous knowledge in research by and for Arctic communities; education, by creating culturally-relevant experiential curricula rooted in Inuit knowledge to engage youth in Arctic science; and stewardship, by advancing environmental and cultural stewardship towards sustainability and healthy communities and ecosystems.

Mulubrhan Gebremikael, UNEP-IEMP (International Ecosystem Management Programme), stressed that traditional and indigenous knowledge is the most accessible, affordable and relevant source of weather and climate information for pastoralists. He explained that this is the case because traditional knowledge: presents information at scales relevant to daily livelihood decisions; is based on diverse sources of information; and is continuously refined and updated. He noted that co-production with science may provide synergies and new sources of knowledge and understanding.

Jozelin Soto, Milpa Maguey Tierno de la Mujer Sss, Mexico, gave examples of how traditional knowledge contributes directly to achieving various SDGs related to nutrition (SDG 2), health (SDG 3), climate change (SDG 13), and biodiversity conservation (SDG 15).

In the subsequent discussion, an indigenous stakeholder said that traditional knowledge is wisdom and science, and achieving the SDGs, addressing climate change, and financing all have to work together to ensure we can live in peace. Thailand said that local communities can offer unique solutions to local problems and described innovations developed by local communities in his country. UNESCO said that the co-production of knowledge can be a rich source of innovation, but that good practices and policies to foster indigenous knowledge are few and far between.

In conclusion, Cunningham said it is clear there is a space for building synergies between traditional and local knowledge systems to implement the SDGs and there are experiences we can learn from and share on how indigenous peoples and Member States are bridging knowledge systems. Gadelha said that we cannot leave important systems of knowledge behind and the question of co-design is an important feature of STI for the SDGs.

Session 8: Supporting the implementation of the Technology Facilitation Mechanism – the way forward for joint action

Co-Chair Sandoval opened this session noting it will present a number of initiatives from across the world that support the science-based, solution-oriented, multi-stakeholder, and collaborative approach of the TFM. He said the TFM is quite

recent and still can be improved so we can ensure the left hand knows what the right hand is doing and improve communication and coordination to achieve the SDGs.

Moderator Peter Gluckman, Chair, International Network for Government Science Advice, said that it is important to strengthen and better integrate policy silos both horizontally and vertically. He added that no one doubts the importance of STI, but there is much that needs to be done, including a broad definition of science to include social science and indigenous and local knowledge. He concluded that the TFM needs an online platform for access to knowledge technologies to meet its full promise.

Alfred Watkins, Chair, Global Solutions Summit, quoted the late Vanu Bose that it takes more creativity and innovation to market a new invention than it did to invent it in the first place. Noting that proven, cost effective solutions already exist, he invited collaboration to address the challenge that the deployment of these solutions poses.

Simonetta Di Pippo, Director of the UN Office for Outer Space Affairs (UNOOSA), said 40% of the SDG indicators are reliant on space science and technology. Space science and technology is essential for well-informed policy making, she stressed, adding that 70 UN Member States have established space agencies. She described UNOOSA's work on bridging the "space divide" between those who have access to space science and those who do not.

Veerle Vandeweerd, Policy Director, Global Sustainable Technology and Innovation Conference (G-STIC), stressed the need for raising awareness among engineers about the SDGs, leaving no one behind, and addressing climate change to inform market-based solutions.

Rafat Al-Akhali, Pathways for Prosperity: Commission on Technology and Inclusive Development, highlighted the importance of multi-stakeholder collaboration in addressing the tradeoffs inherent in current rapid technological development.

In the subsequent discussion, United Nations University described a successful capacity-building workshop held in Amman, Jordan in April 2018 under the auspices of the IATT, noting that its success was due in part to the fact that seven UN agencies jointly developed the concept, material, and training approach. He added that they learned the UN itself is a major depositary of STI knowledge.

A stakeholder from Guatemala said STI can support relations between projects in different communities. The ETC Group said that the key to civil society support is to operationalize the multi-stakeholder nature of the TFM and reflect more multi-stakeholder views in the selection of panelists at the STI Forum. Mexico called for strengthening the inclusive element of the STI Forum and TFM, observing that two days is not enough. She added that the TFM was created for both the 2030 Agenda and the AAAA and that the IATT must cooperate with all agencies linked to technology.

In conclusion, Gluckman said we need to reflect these suggestions for STI 2019 since many more people want to take part. He added that technology needs to be better recognized within the policy mechanisms as a whole in both Member States and the UN system.

Session 9: STI for access to affordable, reliable, sustainable and modern energy for all (SDG 7)

Co-Chair Sandoval opened this session, explaining its focus on the status of existing knowledge and technology, and the potential for how STI can support the achievement of SDG 7 on universal access to modern energy services.

Innovation Pitches: Ben Jeffreys, ATEC* Biodigesters International, described their commercially scalable plug-and-play technology for a biodigester system that provides gas for cooking, electricity and lighting. They have produced over 600 systems in Cambodia and want to expand to five countries and one million systems by 2030.

Keneth Ndua, Jiko Raha, described a simple heat-based system to purify water at low cost. Households can generate the heat that purifies the water when they are cooking. This has changed children's lives in Kenya and he hopes to scale it up and manufacture more units.

Dina Buchbinder, Education for Sharing, introduced their innovation in science and technology education that uses games and sports to foster creative minds and ideas to inspire children and teachers to change the world while learning about science. The programme is focused on both the SDGs and civic engagement, and has reached 900,000 children in seven countries.

Panel Presentations: Agnes Lawrence Kijazi, Co-Chair, 10-Member Group, moderated the panel.

Nebojsa Nakicenovic, Deputy Director General and Deputy Chief Executive Officer, International Institute for Applied System Analysis (IIASA), presented *The World in 2050*, which he said will be presented at the HLPF in July 2018, and its six priority areas: energy, food and biosphere, SCP, digital revolution, smart cities, and human capacities and demography.

Jim Watson, Director, UK Energy Research Centre and University of Sussex, said 29% of our energy could come from renewables by 2040 and two-thirds by 2050, due to the speed with which the renewable sector develops. He called for a systems approach to innovation and for eliminating fossil fuel subsidies.

Daniel Cardinali, Novozymes, Brazil, spoke about biorefineries' potential to contribute to achieving SDG 7.

Jack Metthey, Director for Climate Action and Resource Efficiency, Directorate-General for Research and Innovation of the European Commission, spoke about the Commission's support of "Mission Innovation," a global initiative of 22 countries and the European Commission that partnered to accelerate clean energy innovation to make clean energy more widely affordable.

In the subsequent discussion, Japan called on every country and international organization to develop a roadmap for the implementation of SDG 7. The Major Group for Children and Youth emphasized the need to support young practitioners in the sustainable energy field and engage diverse stakeholders in the water-energy-food nexus. Colombia asked how the European experience could be transferred to Latin America, which has many energy resources that are unevenly distributed. South Africa said that due to investment in energy infrastructure they have increased access to energy from 60% in 1990 to 94% today.

In response to Colombia, Metthey said for the European experience to transfer elsewhere, coordination and regulation are needed. Nakicenovic said SDG 7 has to be seen in the context of the other SDGs. Watson said, in response to Japan, roadmaps are potentially important but any movement on roadmaps needs to be aligned with capacity building. Cardinali said policies at all levels are necessary to decrease carbon intensity of liquid fuels.

Session 10: STI for inclusive, safe, resilient and sustainable cities and human settlements (SDG 11)

Co-Chair Sandoval introduced the session to discuss the status of existing knowledge and technology, and explore the potential for how STI can support the achievement of SDG 11 on sustainable cities and human settlements.

Innovation Pitches: Patricia Alata, Ocupa Tu Calle, described how her organization focuses on improving public urban spaces by using sustainable materials and local communities to create a large impact with a small investment. Nearly 500,000 people in Lima, Peru, have used their public spaces. They are working with UN Habitat on a toolbox so anyone can use their model to build citizenship, provide dignity to public spaces, and improve the quality of life.

Santosh Poudel, founder of Waste Service, Nepal, described the city-based common hospital waste treatment facility that they developed to help hospitals and local governments manage the hazardous waste generated from hospitals. This cost-effective example of a public-private partnership can achieve six SDGs and they hope to expand to the more than 50 urban areas facing the challenge of managing hospital waste.

Panel Presentations: Vaughan Turekian, Co-Chair, 10-Member Group, moderated the panel.

María Victoria Sukenik, Vice-Chairman of U4SSC (United for Smart Sustainable Cities), Argentina, explained that U4SCC is currently working on:

- guidelines on tools and mechanisms to finance smart sustainable cities projects;
- guidelines on strategies for circular cities;
- city science application frameworks;
- blockchain for cities;
- guiding principles for AI in cities;
- the impact of AI and cognitive computing in cities;
- the impact of data processing and computation in cities; and
- the impact of sensing technologies and Internet of Things in cities.

Yunus Arikan, Head of Global Policy and Advocacy at ICLEI – Local Governments for Sustainability, Turkey, called for looking at cities as innovation hubs and using multilevel collaboration to turn diplomacy into action to transform human civilization in a low-carbon, high-resilient civilization.

Kamal Bhattacharya, Chief Executive Officer, Safaricom Innovation Hub, Kenya, invited using technologies to rethink how to run cities. Noting that the digital infrastructure became a dual representation of the physical infrastructure, he pointed out that the former, unlike the latter, does not largely belong to the government but to the private sector. Observing that the private sector needs to find solutions for resilience but also to design products that consumers want, Bhattacharya emphasized that bridging this gap between data ownership and usage is essential.

David Edwards, Harvard University, said we need to turn, through technology, the density of our environments in cities into sensory opportunities to increase our quality of life. However, he cautioned, this raises the issue of data usage and privacy. He

called for using the artistry of cultural diversity and exchanges to inform policy decisions that capitalize on opportunities and minimize risks.

In the subsequent discussion, the Major Group for Children and Youth called for inequality to be reduced in cities and urged city governments to encourage interdisciplinary study of data and reveal details of algorithms used for decision-making. Future Earth stressed the importance of science and research in cities and the importance of systems-based approaches. Japan said that cities and city roadmaps are important for achievement of the SDGs. Resilience Brokers stressed that an open data infrastructure is of vital importance to achieving the SDGs and the Sendai Framework for Disaster Risk Reduction. The International Atomic Energy Agency (IAEA) explained how nuclear science and technology can make a contribution to several of the SDGs and that the IAEA provides technical support to Member States.

In response, Edwards said that it is difficult to impact sustainable development challenges without broad international engagement and the STI Forum needs to be measured by the impact it has and be continually re-evaluated. Sukenik stressed the importance of involving stakeholders in achieving the SDGs. Arikan said the key message is that all sustainability efforts make sense if they reach into cities. Bhattacharya said he hoped we can move towards a world of incubators between the public sector and the private technological sector.

Conclusions and Next Steps

Co-Chair Hoshino opened the session on conclusions and next steps.

Innovation Pitch: Christopher Fabian, UNICEF Office of Innovation, introduced the UN Innovation Network, an informal group of innovators that the Secretary-General tasked with learning how the UN system can use technologies and systems to do its work better. He described the work on drones and unmanned aerial vehicles to deliver vaccines and emergency aid to people in need, and the use of data science to understand the way people and diseases move in real time. He invited everyone to be a part of the UN Innovation Network and start to understand how technologies can help to fundamentally change humanity.

Discussion: In the discussion on next steps for the STI Forum, Mexico highlighted the need for international collaboration between countries and collaboration with the private sector to enable developing countries to benefit from the advances in technology. He also noted the necessity to adopt integrated national STI roadmaps.

For upcoming sessions of the Forum, the Commons Cluster proposed breakout sessions during lunch breaks or after the Forum, so participants could engage more directly with the panelists. Japan called for greater commitment from the global science communities. South Africa emphasized the need for regional perspectives. The World Bank proposed to investigate if STI contributions could be integrated "more tightly" in SDG implementation, possibly through the national STI roadmaps. The ETC Group called for more space for dialogue with civil society.

Co-Chair Hoshino thanked everyone for their useful comments. He said that STI is a force to make use of limited resources to achieve the SDGs, but STI is not just advanced technologies but also indigenous technologies. He added that STI is not an issue

that only governments should discuss and thus the STI Forum allows multi-stakeholder insights and input to be taken into account.

Co-Chair Sandoval noted that the STI Forum is "for our people, thus our success can be measured by development that reaches our people and communities." He added that we need an inventory of good practices and public policies for each of the SDGs. He said that we must measure exactly where each of our countries must go and what specific public policies should be used. He asked participants to reflect on these points at the upcoming meetings of the HLPF and the UN General Assembly.

ECOSOC President Marie Chatardová said she was pleased to see the TFM and the STI Forum evolving and strengthening over time. She further noted that she looks forward to further results from the work ahead. She thanked the Co-Chairs and the 10-Member Group for helping to prepare and guide the STI Forum, along with the UN DESA, and the other members of the IATT. She added that she looked forward to seeing the summary of the meeting. She thanked all the participants and encouraged everyone to stay engaged.

Chatardová declared the STI Forum closed at 6:00 pm.

Glossary

AAAA	Addis Ababa Action Agenda
AI	Artificial intelligence
ECOSOC	UN Economic and Social Council
HLPF	High-level Political Forum on Sustainable Development
IATT	Inter-Agency Task Team
LDCs	Least developed countries
SCP	Sustainable consumption and production
SDGs	Sustainable Development Goals
STI	Science, technology and innovation
TFM	Technology Facilitation Mechanism
UN DESA	United Nations Department for Economic and Social Affairs
UNESCO	United Nations Educational, Scientific and Cultural Organization