



# Economic and Social Council

Distr.: General  
26 May 2022

Original: English

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## High-level political forum on sustainable development

Convened under the auspices of the Economic and Social Council  
5–7 and 11–15 July 2022

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

### Note by the Secretariat

The President of the Economic and Social Council has the honour to transmit to the high-level political forum on sustainable development the Co-Chairs' summary of the multi-stakeholder forum on science, technology and innovation for the Sustainable Development Goals, held in person with online participation on 5 and 6 May 2022, with an additional day of side events on 4 May. The Co-Chairs of the forum, the Permanent Representative of the United Republic of Tanzania to the United Nations, Kennedy Gastorn, and the Permanent Representative of Ukraine to the United Nations, Sergiy Kyslytsya, were appointed by the President of the Council. The summary is being circulated pursuant to paragraph 123 of the Addis Ababa Action Agenda of the Third International Conference on Financing for Development (General Assembly resolution [69/313](#)) and paragraph 70 of the 2030 Agenda for Sustainable Development (resolution [70/1](#)).



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

### **I. Introduction**

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

2. Pursuant to General Assembly resolution 70/1, on 5 and 6 May 2022, the President of the Economic and Social Council, Collen Vixen Kelapile, convened the seventh annual science, technology and innovation forum. As a component of the Technology Facilitation Mechanism, the forum is a venue to discuss cooperation in science, technology and innovation around thematic areas pertaining to the implementation of the Sustainable Development Goals, bringing together all relevant stakeholders to actively contribute in their areas of expertise. The forum provides a venue for facilitating interaction, matchmaking and the establishment of networks and multi-stakeholder partnerships. It also aims to identify and examine needs and gaps in terms of technological solutions, scientific cooperation, innovation and capacity-building and to examine the impact of rapid technological change on the Goals in the light of the coronavirus disease (COVID-19) pandemic.

3. The Permanent Representative of the United Republic of Tanzania to the United Nations, Kennedy Gastorn, and the Permanent Representative of Ukraine to the United Nations, Sergiy Kyslytsya, co-chaired the forum. The forum was jointly organized by the United Nations inter-agency task team on science, technology and innovation for the Sustainable Development Goals, led by the Department of Economic and Social Affairs and the United Nations Conference on Trade and Development, and the United Nations 10-Member Group to Support the Technology Facilitation Mechanism, serviced by the Department of Economic and Social Affairs.

4. The opening of the forum featured statements by the President of the Council, Collen Vixen Kelapile, the President of the General Assembly, Abdulla Shahid, and the Secretary-General (remarks delivered by the Under-Secretary-General for Economic and Social Affairs).

5. Two keynote speakers set the scene for the forum: the Vice-Prime Minister and Minister of Education, Tertiary Education, Science and Technology of Mauritius, Leela Devi Dookun-Luchoomun; and the National Science Adviser to the President of the United States of America and former Director of the National Institutes of Health, Francis Collins.

6. The forum was held in person at United Nations Headquarters, with the option for online participation, which was the option preferred by most participants and speakers. The forum was well attended and included representation from Governments, scientists, innovators, technology specialists, entrepreneurs and civil society. Thirty-three government ministers addressed the forum. To facilitate online participation, the forum utilized an online platform on which all official and informal sessions, events exhibitions and online booths were held. The forum reached a record number of participants, with more than 3,800 participants registered on the online platform alone. Many more participated through alternative platforms or followed the forum live on United Nations Web TV, where the recordings continue to be viewed.

Online participation also facilitated strong engagement and networking between speakers and participants; for example, some 9,000 messages were sent between the participants on the dedicated online platform. The forum also included a record number of sessions, special events and speakers. The official programme of the forum featured 131 speakers, while hundreds more spoke at 50 side events and other related events. A total of 22 online virtual exhibition booths showcased winners of United Nations innovation competitions and flagship publications on emerging science and technology. Many scientists and engineers from academia, the private sector, the United Nations system and government entities submitted science-policy briefs to highlight key emerging issues arising from their research and for which they proposed policy action. Of those briefs, 65 passed the peer-review stage and were made available to support the forum's deliberations.

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

7. The forum deliberated on the role of science, technology and innovation in “building back better” from the COVID-19 pandemic and accelerating progress towards the achievement of the Goals, with an emphasis on Goals 4 on quality education, 5 on gender equality, 14 on life below water, 15 on life on land and 17 on partnerships – the Goals being reviewed in depth at the 2022 meeting of the high-level political forum on sustainable development.

8. The science, technology and innovation forum provided a timely opportunity to identify solutions to a number of challenges that the world is currently facing, ranging from the COVID-19 pandemic to the impacts of artificial intelligence, education and technology gaps, climate change and the wider global effects of the war in Ukraine. These crises have halted or even reversed years of development progress in many countries, threatening to put the Goals out of reach and triggering a lost decade for developing countries. The forum highlighted science, technology and innovation solutions to support the achievement of the Goals.

9. Among other issues, the forum examined the actions needed to enhance national, regional and global innovation ecosystems and research cooperation and partnerships, assessed the promises and potential risks of emerging science and technologies and discussed technological divides. It showcased concrete solutions in the areas of carbon dioxide removal technologies and identified lessons learned by policymakers from the latest sustainable development scenarios. It linked directly to the inter-agency task team work streams on science, technology and innovation road maps for the Sustainable Development Goals, emerging science and technologies, capacity-building and gender, as well as initiatives such as the Global Sustainable Technology and Innovation Community, the “Partnership in Action” on science, technology and innovation road maps for the Goals and the International Network for Government Science Advice of the International Science Council.

10. The forum also reflected on the role of innovation in education and addressed the need to close the digital divides and to ensure governance of digital public goods. The forum concluded with a discussion of opportunities and the way forward for the Technology Facilitation Mechanism and associated global and regional initiatives. 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 Goals.

11. Members of the 10-Member Group moderated most of the sessions and provided elements of a vision on science, technology and innovation for the Goals.

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

### **A. Science, technology and innovation at the coronavirus disease conjuncture**

13. The forum discussed the extraordinary circumstances created by the COVID-19 pandemic, which has greatly aggravated inequalities between and within countries, leaving the most vulnerable furthest behind. It is of paramount importance to include the most vulnerable, the very populations that have been hardest hit, in emergency responses.

14. Solidarity is at the heart of building back better from the COVID-19 pandemic. However, many countries, especially in Africa, continue to lack vital medical supplies, and there is a pressing need to use technology to bridge the access gap and reduce inequalities. International cooperation, including South-South cooperation and multi-stakeholder partnerships, needs to be reinvigorated to mobilize and harness science, technology and innovation in order to accelerate progress towards sustainable recovery and development. The COVID-19 pandemic has brought to the fore the merits of a multilateral, multi-stakeholder approach, and underscored the importance of further strengthening coordination and synergies between countries and academic institutions in order to optimize crisis preparedness, response and recovery processes at the global, regional and national levels.

15. There is a pressing need for capacity-building on medical and pharmaceutical technologies; national emergency strategies and risk-informed, science-based science, technology and innovation policies that are responsive to local needs; and strong and flexible public institutions beyond the health sector, in support of the wider Goals. To better prepare for and manage crises, technical capacities related to information and data need to be strengthened. Knowledge generation should be treated as a public good, and the forum highlighted the need for effective knowledge-sharing at the global level.

16. To build resilience, targeted efforts are needed to engage marginalized populations, persons with disabilities, indigenous peoples, women and girls and young people in science, technology and innovation policy development and implementation processes.

17. Openness and transparency are of paramount importance. Scientists, engineers and innovators need to be able to voice contrary opinions without fear of reprisal, and COVID-19-related policy decisions need be informed by scientific evidence.

18. Major progress is being made in research on new kinds of vaccines that will protect against COVID-19 and other coronaviruses and on ways to prevent continued infections. Global cooperation on research and deployment and greatly increased levels of funding are urgently needed to make sure that the world is prepared and able to provide access to vaccines and related medical supplies for all.

### **B. Innovations in education: towards quality access and common good**

19. The forum discussed how to increase access to and the quality of education and examined advancements in digital learning and education technologies (known as edtech), including in the context of the COVID-19 pandemic and beyond.

20. Education is a driving force that powers economies and societies, while promoting a more environmentally sustainable world. The purpose of education ought to be to teach students how to learn, instil in them a lifelong love of learning and foster the flexibility and resilience that they may need to innovate at short notice and adapt to external shocks.

21. Education methods in the digital era should be tailored to the specific economic, social, ethnographic and technological situation of a community or country. Digital technologies used for education may need to be adapted to the contexts in which they are used, while also ensuring that certain human rights, such as freedom of speech and access to information, are respected. Developing self-awareness and self-reflection is indispensable for students to be able to maintain their sense of belonging and identity according to their social, cultural, racial and ethnic backgrounds in the context of their increasing participation and involvement in a digital, globalized environment.

22. Transforming educational systems need to be aimed at building character, judgment, empathy, resilience, social awareness and responsible citizenship, in addition to imparting knowledge. Education must strengthen social, emotional and ethical learning grounded in basic human values such as compassion and solidarity. There is a need for grass-roots, people-centred change that takes into account local needs and the cultural context rather than focusing solely on technological advances.

23. The important roles of teachers and educators needs to be recognized, including through policies that support their work. Teachers need adequate resources and continuous professional development. More support is needed to prepare teachers for digital technologies and modern teaching methods. Hybrid formats, in particular, can be used to access the latest knowledge, while also enabling the human contact and nurturing environment that children often need for their development. New policies, investments and partnerships are needed to mobilize education technologies for institutions, teachers and students. Personnel in the public education sector also need training on procuring digital tools, accessing digital content and making use of open education resources.

24. The COVID-19 pandemic has affected over 90 per cent of students globally. In addition to a loss of formal education, children and young people have lost out on social, emotional and cognitive education, which are critical to child development and academic learning. Social isolation and unsafe learning environments have had an adverse effect on many students' mental health.

25. The COVID-19 pandemic has accelerated the adoption of digital technology in education and has created a shift in cultural attitudes towards education technologies in those parts of the world that have the necessary infrastructure in place. Technology is increasingly being perceived as the point of arrival in the future of education; however, it is important to note that, at the global level, the pandemic has exacerbated the gap in access to technology. Students need better access to digital devices and affordable, high-quality Internet connectivity. Technology alone is not interactive enough for child development, and the use of technology is associated with certain downsides.

26. The COVID-19 pandemic has revealed the difficulties associated with explaining and understanding science. In many parts of the world, science literacy levels remain abysmal, and scientists struggle to reach the layperson; there is a hierarchy of who should understand science and who is owed an explanation. This failure has led to the growth of misinformation and to an unnecessary crisis in relation to vaccinations. People can understand science, and if they do not then better ways need to be found to explain it to them in their own contexts.

### **C. Global, national and local innovation ecosystems and science, technology and innovation road maps for the Sustainable Development Goals**

27. The forum discussed the ways in which global, national and local innovation ecosystems could be fostered, and drew attention to local and national approaches to mission-oriented innovation taken by Governments and various stakeholders. In particular, it discussed lessons learned from the inter-agency task team's pilot programme on national science, technology and innovation road maps for the Goals and highlighted good practices in policy and governance.

28. There is a need for strengthened and more coherent innovation ecosystem networks, including among developing countries, and for long-term strategic funding for mission-oriented efforts, for creative ideas, innovators and research and development programmes.

29. While every country's innovation path is specific to its culture and economic characteristics, a number of common system-focused mechanisms and innovation policies can support sustainable development, especially in countries with medium or low technological capacities. Merely upgrading technology along existing trajectories is not enough; holistic, national science, technology and innovation policies are needed.

30. Developing effective science, technology and innovation ecosystems and coordinating actions through science, technology and innovation road maps for the Goals are essential elements of successful Goal-related strategies and actions. The inter-agency task team's global pilot programme on science, technology and innovation road maps for the Goals has been successful in the initial group of six pilot countries,<sup>1</sup> as highlighted in the national reports submitted to the forum. The road map activities carried out under the pilot programme have included capacity needs assessments; mapping of science, technology and innovation ecosystems; and new research and development initiatives. In some cases, efforts have also engaged the subnational government levels. The use of road maps has supported the mainstreaming of science, technology and innovation, aligned with national development planning, and led to the creation of action plans to address societal challenges, including responses to pandemics. Various tools have also been made available in support of road map development, such as the use of the "smart specialization" approach as a local, evidence-based and participatory priority-setting process for research and development investments. The science, technology and innovation road maps for the Goals initiative has also catalysed regional collaboration on entrepreneurship and multimodal approaches to science, technology and innovation road maps in the Arab region.

31. Science, technology and innovation road maps for the Goals are based on multi-stakeholder and multisectoral policy engagement. This requires shared terminology and a shared understanding of science, technology and innovation policy concepts. In this context, the inter-agency task team published an inter-agency guide, together with an operational note and a massive open online course training course. Further synergies need to be built between the inter-agency task team's work streams on science, technology and innovation road maps for the Goals and on capacity-building on policymaking.

32. In order to effectively guide efforts regarding science, technology and innovation road maps for the Goals in a scalable, equitable, systemic, collaborative and global manner, the 10-Member Group has proposed the creation of an international network for banks of ideas and funds for innovation, which would become a repository to aid in

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<sup>1</sup> Ethiopia, Ghana, India, Kenya, Serbia and Ukraine.

the identification of problems, opportunities and solutions that would be open to all. It would also become a mechanism for the generation, legal protection, management and financing of a portfolio of best ideas, innovation projects and opportunities to create new, sustainable markets within the framework of the Goals.

33. Science, technology and innovation road maps for the Goals could also support aspects of the voluntary national reviews submitted every year by Governments to the high-level political forum on sustainable development. Voluntary national reviews should take into account the cross-cutting and multi-stakeholder nature of science, technology and innovation for the Goals, with innovation being acknowledged as a horizontal enabler for achieving all of the Goals.

#### **D. Lessons learned from science advice for policymaking**

34. The forum emphasized that the interfaces between evidence, policy and society have never been more visible or more critical than during the COVID-19 pandemic. The crisis has brought about unprecedented shifts in the relationships between societies and science, politics and evidence, and society and Governments. Science advice for policymaking is now viewed as critical for informing policy solutions and underpinning the public trust necessary to implement those solutions successfully. The scientific method should be the arbiter of trusted facts and could – and should – include the continual challenging of ideas.

35. The experience of the COVID-19 pandemic has made it clear that policymaking needs to draw on a broad range of natural and social scientific disciplines. Societies need to be able to leverage scientific data and evidence in order to inform their policymaking processes.

36. Science advice within the multilateral system is dependent on the success and culture of science advice at the national level, as well as the definition of effective processes at the multilateral level. The challenges associated with science advice at the international level generally reflect those faced at the national level. Distinctive mechanisms for the synthesis of evidence and for scientific advice brokering are needed.

37. Communication of and engagement with risk-informed evidence is a core part of good science advice. The challenge lies in the fact that evidence about risks related to future hazards, the impacts of which are uncertain in terms of nature, timing and scale, is generally perceived differently to other scientific evidence. Understanding those differences will help in creating and communicating risk-based evidence in more effective ways that lead to more timely attention being paid by the policymaking community.

#### **E. Global digital public goods, digitalization, artificial intelligence and connecting the world by 2030**

38. The forum deliberated on the role of global digital public goods, pervasive digitalization and artificial intelligence trends, and what it might take to achieve a fully connected world.

39. The COVID-19 pandemic has both accelerated the pace of digitalization and widened existing inequalities. Universal and high-quality access to the Internet and to a range of frontier technologies, platforms and data will be essential for achieving the Goals.

40. Despite significant progress on digital connectivity during the pandemic, when global Internet usage rose by 40 per cent during the associated lockdowns, some

2.9 billion people, 96 per cent of them in developing countries, have never even accessed the Internet. The transformative power of digital technologies also presents other challenges, ranging from issues of transparency, security, trust and privacy to biases, job losses and rising socioeconomic inequalities. Democratizing access is essential. On top of the existing connectivity divide, a digital data divide is also emerging, and identifying the best methods for governing and harnessing large amounts of digital data for the global common good has become a major challenge. Globally, there are diverging approaches to the governance of data and cross-border data flows. Innovative approaches to global data governance are urgently needed, as the old ways may not be well suited for responding to the new realities.

41. Global digital public goods can be the means for building common solutions to common challenges and facilitating global cooperation. Public funding is essential for digital public goods to ensure inclusive governance and stakeholder participation. The global private capital markets are not investing enough in the ability of people to create public digital futures and infrastructure, resulting in great disparities.

42. Positive narratives of digital innovation are needed to offer a vision of a “digital utopia” that incorporates sustainability and inclusiveness, including gender equality. In this regard, a global, positive vision could help in resisting fragmentation. Internet governance by the people for the people, based on multi-stakeholder participation, should be explored; much could be learned from the multi-stakeholder model provided by the Internet Governance Forum.

43. The Global Digital Compact proposed by the Secretary-General in his report entitled “Our Common Agenda” ([A/75/982](#)) could strengthen global cooperation in this space. The preparatory process for such a compact should bring together those stakeholders that are working towards forging a common understanding of and adherence to common principles for the digital future. Discussions on global connectivity, the role of digital public goods and emerging technologies form part of the broader efforts of the United Nations to build towards such a shared understanding.

44. Global inequalities remain considerable in terms of access to digitalization. Strengthened global cooperation among development partners, the private sector and other stakeholders is needed to address key issues, such as the lack of infrastructure, data skills and literacy. Efforts are required at the international level to establish common principles and objectives with a view to addressing interconnected global challenges, maximizing the advantages of the digital economy and digitalization, ensuring an equitable distribution of those advantages and minimizing the risks involved.

45. Young people require training to equip them with the skills to engage with and advocate digital equality. Digital innovation and mentorship programmes can help in this regard.

## **F. Science and technology futures and scenarios for the Sustainable Development Goals and beyond: what is possible and what does it take?**

46. The forum took note of recent findings by leading scenario analysts from science and technology futures and scenarios. It looked at which Goals were possible to achieve and what it would take in terms of policies and actions to achieve them.

47. Since 2015, scenario analysts have developed scenarios for the Goals, emphasizing economic, technological or political approaches. However, in the past eight years, unabated global increases in energy, materials and land use, together with their associated environmental, social and health consequences, have required

analysts to make increasingly ambitious assumptions to arrive at scenarios in which the Goals are achieved in the remaining few years.

48. Recent sustainable development scenarios show pathways towards ensuring decent living standards for all. Such scenarios take into consideration much more than basic services and the eradication of poverty, incorporating nutrition, shelter, health, socialization and mobility. Less than one third of the current global average of annual final energy consumption per capita is needed to provide decent living standards. The largest per capita gaps are in sub-Saharan Africa, South Asia and Latin America, but regional differences also remain sizable.

49. Energy gaps affecting decent living standards are most evident in transportation across regions and in clean cooking, cold storage, sanitation and cooling. The gap in cooling is especially wide in South Asia. In many parts of the Global South, cooling accounts for one of the fastest-growing uses of energy in buildings, yet only rarely is the focus on sustainability. Heat stress affects the health and productivity of billions of people.

50. Without a successful and rapid sustainable energy transition at the global level, most of the other ambitions to achieve the Goals will also remain out of reach. Clean energy solutions have the potential to deliver universal energy access in a way that is safe and that drives economic development for all.

51. Nonetheless, despite continued unsustainable trends, recent sustainable development scenarios show that the Goals and climate targets remain within reach. It is still possible to ensure decent living standards for all, including in developing countries. Malnourishment can be halved by 2030, zero hunger can be achieved by 2050, the number of people affected by extreme poverty can be reduced to 180 million by 2050 and rapid income growth in developing countries can be ensured.

52. In order for such goals to be attained, appropriate policies must be adopted and investment stepped up with regard to research and the sharing of technology, all in line with sustainable development as the ultimate objective. Effective governance and institutions are critical, as are peace, international cooperation and solidarity. The energy transition is a powerful enabler for realizing all these advances and the Goals. In all areas, there is need for political will, focus, continuing research and development, and international cooperation and solidarity.

53. The United Nations should partner with the technology scenario community in order to be able to translate the results of their findings into accessible and easily understandable lessons and policy ideas and to be able to provide advice on the potentials of emerging technologies, for example in the form of a technology policy lab.

## **G. Emerging carbon dioxide removal technologies for addressing climate change**

54. The forum deliberated on the potential of emerging carbon dioxide removal technologies for addressing climate change, in the light of the findings in the sixth assessment report of the Intergovernmental Panel on Climate Change, in which the Panel highlights that need for such technologies, regardless of action on reducing greenhouse gas emissions. While mitigation should remain the primary goal and is expected to contribute towards reducing greenhouse gas emissions by about 90 per cent, carbon dioxide removal technologies could help to fill the remaining gaps, in particular in industries whose processes are difficult to decarbonize, such as those that produce steel, cement or petrochemicals.

55. Carbon dioxide removal technologies include both nature-based and technology solutions and focus on terrestrial or ocean systems. For example, traditional methods

that incorporate biochar have long been in use and provide agricultural co-benefits. Trees also provide a nature-based solution for carbon dioxide removal. New technologies hold great potential, but many are still in the testing stage and will require sizable investments if they are brought to scale. Additional research is needed to assess their impacts on terrestrial and ocean ecosystems and to see how they will perform at scale in various parts of the world.

56. Carbon dioxide removal solutions such as biochar are often used in rural areas or areas occupied by indigenous communities. Special attention is therefore needed to ensure that the technologies involved are implemented in a way that is both environmentally and socially sustainable.

57. At both the national and international levels, specific policy agendas are required to monitor, assess and report on carbon removal, as well as to exploit economies of scale. International organizations could support the establishment of standards and promote the use of carbon dioxide removal. New technologies such as drones, artificial intelligence and machine learning, could help to monitor carbon emissions and the effectiveness of carbon dioxide removal. Sensors and digital technology could form the basis for reliable monitoring systems with international cooperation at their core.

58. In order for carbon dioxide removal technologies to be truly sustainable, they should serve as supplemental measures to climate mitigation actions; they should not be used as a justification for business-as-usual, in particular for carbon-intensive sectors. This will require the development of a greenhouse gas market for carbon dioxide removal that would be separate from the markets that are focused on mitigation.

## **H. Emerging science, frontier technologies and the Goals: perspectives from the United Nations system and science and technology communities**

59. The advancement of emerging science and frontier technologies is accelerating against the backdrop of the extreme uncertainties and complexities of today's world. The forum discussed the potential and risks of such evolving science and technologies, in particular in relation to the achievement of the Goals.

60. A number of new science, technology and innovation products and services have been made available, while existing standards remain inadequate to keep up with rapid technological changes. There is a pressing need for robust, integrated regulatory frameworks to drive the development of science, technology and innovation in the direction towards the achievement of the Goals.

61. Participants underscored the need for local frameworks to guide artificial intelligence technologies that are at the forefront of the fourth industrial revolution. For instance, artificial intelligence technologies may contribute towards such benefits as enhanced productivity and sustainability in the contexts of livelihoods within rural communities, but incorporating such technologies as possible solutions and undertaking such efforts should be demand-driven, based on grass-roots realities and meaningful consultation with local stakeholders, including the most vulnerable.

62. It is critical for policymakers to consider the potential socioeconomic and environmental implications of artificial intelligence while the technology is at the research and development stage and to consider the entire life cycle of technology products and services.

63. Green windows of opportunity for development are inherently indigenous, meaning that national and local governments can own and develop tailored policy

responses that work. Development cooperation has a key role to play in supporting indigenous strategies that promote sustainable development, including through South-South transfer of technology.

64. New technologies can contribute towards ensuring that no one is left behind and towards making marginalized populations more visible through large-scale data collection and management. For example, social media platforms can scan the real-time participation of different demographic groups worldwide, thus providing meaningful insights for policymakers.

## **I. Findings of the Technology Facilitation Mechanism on the impacts of rapid technological change on the achievement of the Goals**

65. In line with General Assembly resolutions [72/242](#) and [73/17](#), the Assistant Secretary-General for Policy Coordination and Inter-Agency Affairs presented an update on the findings of the Mechanism on the impact of rapid technological change on the achievement of the Goals. The findings, documented by the inter-agency task team on science, technology and innovation, represent a collaborative, multi-stakeholder effort, including by experts from the United Nations system and beyond, through various meetings, and 65 dedicated, peer-reviewed science-policy briefs. Substantial contributions were also made by the United Nations 10-Member Group, experts from the United Nations system and external experts.

66. The findings revealed the changes experienced owing to the COVID-19 pandemic and what their implications for the way forward with regard to science, technology and innovation were. It was concluded that the 2019 and 2021 findings remained valid, but that new elements would need to be added, in particular those indicated below.

67. There are critical institutional gaps to be filled to support modern innovation systems. The proposals put forward included the creation of: a network of banks of ideas and funds for innovation, led by autonomous, ethical councils; and a network of impact entrepreneurs and for advisory services.

68. Many existing engineering codes and standards are not adequate for addressing a changing climate. The engineering profession globally should review and update them and increase capacity-building. The United Nations may wish to consider formally recognizing the role of engineering standards for the Goals.

69. The next high-tech waves emerging from basic research labs are rapidly remaking development models, and large corporations are increasingly in the lead in all aspects of these trends. Much greater funding is needed for basic research and for collaboration between academia and industry. International innovation cooperation initiatives are needed to support joint demonstration projects by companies and public institutions.

70. New products and services with new characteristics are emerging that require specific regulatory and policy solutions. For example, “deep neural networks” now surpass human cognitive capabilities in narrow tasks. Unbeknown to many, narrow artificial intelligence has become ubiquitous in many countries, but billions remain excluded from its benefits.

71. Scientists need to develop accessible scenarios and define long-term goals that support global policymaking. In the context of the United Nations, the recent recommendations by the United Nations Educational, Scientific and Cultural Organization on the ethics of artificial intelligence and on open science are very

notable. Arguments have been made for a new “manifesto” for science, technology and innovation.

72. A major international effort is required to deploy and synthesize technology and scientific data for providing a global picture, in real time, to support decision-making on climate change, the Goals and human rights and should include accessible, reliable information on the “break even” points for popular technologies. It could include sustainability footprint calculators bringing together all that is already known from assessments of the true costs of technologies.

73. Science-policy briefs produced by the Mechanism also contain proposals for policy action related to a number of specific technologies, such as access to Tiny Machine Learning as a low-power, low-cost technology; molecular pharming; the metaverse; integrated advanced oxidation for water sanitation; modular 3-D printing construction; cement recycling; bioplastics from urban waste; certified biodegradable materials; hydrometallurgy and recycling of electric vehicle batteries; urban food forests and aquaponics; cooling gaps; bladeless wind power; recycling of face masks; and electrification and hydrogen for attaining carbon neutrality.

74. The findings of the Mechanism continue to highlight that the deep transformations required for achieving the Goals can only come about with rapid scientific and technological change. Going forward, the findings illustrate areas for the work of the interagency task team and its interested partners, in order to add value and advance understanding in support of decision-making.

## **J. Ministerial session on science, technology and innovation for the Goals and a sustainable recovery from the COVID-19 pandemic**

75. The forum included a ministerial session that was closely aligned with the overall theme of the 2022 high-level political forum on sustainable development, “Building back better from the coronavirus disease (COVID-19) while advancing the full implementation of the 2030 Agenda for Sustainable Development”. The discussion focused on good practices for equality, science, technology and innovation road maps for the Goals, science, technology and innovation for resilience-building, science, technology and innovation towards low-carbon economies and lessons learned in utilizing science, technology and innovation for Goals 4, 5, 14 and 15.

76. The forum heard representatives of the following countries share the experiences of their countries with the role of science, technology and innovation as a central element of national development strategies, policies, and programmes: Armenia, Belarus, Bolivia (Plurinational State of), Brazil, China, Colombia, Dominican Republic, Ecuador, Ghana, Guatemala, Honduras, India, Japan, Malaysia, Oman, Philippines, Poland, Portugal, Russian Federation, Saudi Arabia, Slovakia, South Africa, Thailand and Ukraine. Several countries also provided written statements, which are available on the forum website.<sup>2</sup>

77. The paragraphs below include some of the issues, challenges and recommendations discussed at the forum.

78. The COVID-19 pandemic has caused untold suffering and major challenges to policymaking but it has also provided an opportunity to reshape development paths. Decision-making has been substantially supported by the science community and data analysis. In some cases, this has led to the establishment of high-level committees to address the most pressing issues. Science, technology and innovation initiatives remain critically important for a rapid recovery from the pandemic and for the

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<sup>2</sup> See <https://sdgs.un.org/tfm/STIForum2022>.

achievement of the Goals. Innovation not only benefits the economy through long-term growth, modernization of industry and jobs, but also addresses social and environmental concerns. Science, technology and innovation plays a key role in climate action initiatives and policies.

79. Countries showcased numerous initiatives to enhance science, technology and innovation ecosystems. Funds for technology and innovation have been established in many countries and, at competitions, have been used to award the most innovative ideas and research projects, including on medical and biomedical equipment, and to create new scholarship programmes. Many countries have provided funding support to bridge the economic gap in the post-COVID-19 period, mitigating impacts on enterprises through the technological upgrading of micro-, small and medium-sized enterprises, in order to increase their competitiveness and productivity. Some Governments have developed and financed technology-driven city, society and business models, focusing on areas such as poverty eradication, green and low-carbon industrial transitions.

80. Gender equality has been mainstreamed in many countries in order to upgrade the skills of citizens in the digital era, with attention given as a matter of priority to the participation of women and girls in training on the use of digital tools and in the science, technology and innovation workforce.

81. The forum heard many examples of the rapid uptake of digitalization since the start of the pandemic. Mobile applications and virtual platforms, in particular, have ensured continued delivery of public services and business transactions. Digital health applications have promoted people-centred health and disease prevention and improved the resilience of health systems. Health mobile applications have joined efforts with social media and drones in raising awareness about the impacts of the pandemic and about the importance of statistics.

82. Good practices on scaling-up infrastructure and tools, programmes and services for smart hospitals and wards were also presented. Emphasis continued to be placed on the need for vaccine research, manufacturing and distribution programmes, and on the need for access to vaccines to become a key element of future research and development efforts.

83. Connectivity is indispensable for the continued functioning of educational systems. The inclusiveness of science, technology and innovation initiatives is deeply intertwined with open access to Internet services. The vulnerable situation of rural communities raises concerns, as they are often excluded from national services coverage.

84. The development and application of high-tech, such as artificial intelligence and quantum computing, were identified as a top priority by many countries. Deployment of such solutions is being scaled up, but the increasing role of science, technology and innovation poses challenges with global reach, such as privacy rights and misinformation, which require global responses.

85. International, multi-stakeholder cooperation, involving policymakers, entrepreneurs, the private sector, academia, youth and civil society, is fundamental for achieving common goals. Pooling efforts can help with post-COVID-19 recovery efforts, especially in least developed countries and small island developing States, in view of their small economic size. Many partnerships have been launched to promote exchange and cooperation on research (e.g. Atlantic International Research Centre), on innovation (e.g. Latin American Network for Innovation and Entrepreneurship), on vaccines (e.g. the BRICS Vaccine Research and Development Centre), on energy (e.g. China-Ghana-Zambia South-South Cooperation on Renewable Energy Technology Transfer), and on science, technology and innovation road maps for the

Goals (e.g. deployment of high-tech devices in the production of the road maps and distribution of spices in India).

## **K. Innovation exhibit and engagement with eminent women scientists and engineers**

86. The forum organized a virtual exhibit that featured the winners of recent United Nations innovation competitions by the World Trade Organization, the Office for Outer Space Affairs, the United Nations World Tourism Organization, the United Nations Industrial Development Organization, the World Food Forum and the Economic Commission for Africa. Innovators described their cutting-edge initiatives in 17 countries and shared insights on their solutions for economic development, vulnerable populations, the environment, agriculture and space applications.

87. One of the special elements included highlighting the work of three eminent women scientists and engineers. Women continue to be underrepresented in the fields of science, technology, engineering and mathematics, and their representation decreases in higher levels of academia and workplace hierarchy. While there are successful models for improving inclusion, a lack of political will and a lack of funding are key issues. The science, technology and innovation community needs to mainstream gender issues and make a concerted effort to direct technology solutions towards addressing the development challenges facing women.

88. In the context of climate change, there is a need for greater investment and political will to support technology and innovation for vulnerable and disadvantaged groups, including rural populations, low-income people, ethnic minorities, women and youth. Women still face burdens due to limited access to energy and resources. As a result, much of their time is spent on the manual labour involved in agriculture and water collection. There is a need for high-tech solutions for low-tech contexts to reduce the burden on women through technologies that reduce manual labour and increase income-generating opportunities.

## **L. Side events**

89. The following partners of the Mechanism, including three national Governments, organized a total of 50 side events on a wide range of topics: Italy, Slovenia, Department of Science and Innovation of South Africa, Climate Technology Centre, Department of Global Communications, Dag Hammarskjöld Library, Food and Agriculture Organization of the United Nations, International Atomic Energy Agency, International Labour Organization (on behalf of inter-agency task team work stream 10), International Trade Centre, International Telecommunications Union, Office of the Envoy of the Secretary-General on Technology, United Nations Conference on Trade and Development, United Nations Development Programme, United Nations Educational, Scientific and Cultural Organization, United Nations Group on the Information Society, United Nations Environment Programme, United Nations Industrial Development Organization, United Nations Office for Disaster Risk Reduction, World Food Programme Innovation Accelerator, Office for Outer Space Affairs, World Food Forum, World Summit on the Information Society, United Nations World Tourism Organization, CANEUS Organization, Coordinating Body on the Seas of East Asia, Fund for the Development of the Indigenous Peoples of Latin America and the Caribbean, Asia-Europe Foundation, Inter-American Institute for Cooperation on Agriculture, World Federation of Engineering Organizations, Aalen University, AfricaLics, Basel Institute of Commons and Economics, Gratia Christian College, Principles for Responsible Management Education, International

Organization of Employers, Science-Innovation Institute of Sustainable Development (Shenzhen, China), University College Dublin, Bahá'í International Community, Carnegie Council for Ethics in International Affairs, China Association for Science and Technology, Digital Leadership Institute, HaritaDhara Research Development and Education Foundation, Impact Arts Society, International Association for the Advancement of Innovative Approaches to Global Challenges (IAAI GloCha), International Mayors' Communication Centre, International Science Council, children and youth major group, RedLAtM and LACEMOS, Results for Development Institute, National Academies of Sciences, Engineering, and Medicine, UNISC International, United States Council for International Business, World Conference on Higher Education, and XPRIZE Foundation.

## **M. Delivering on the Goals: next steps for the Technology Facilitation Mechanism and its partners**

90. The forum engaged in discussions on elements of a vision for the future of the Mechanism, which were presented by the 10-Member Group and were based on the lessons learned since the Mechanism's inception in 2015. It was stressed that the forum and the work related to the Mechanism had galvanized the understanding of the international community about the great potential of science, technology and innovation to support the realization of the Goals.

91. Interest in and demand for the Mechanism have continued to increase. In 2022, the forum brought together a greater number of participants and discussed a wider array of topics than it had previously. The forum now serves as a truly multi-stakeholder platform and provides a space to renew the commitment to global cooperation and to discuss how to advance the 2030 Agenda. Increased efforts are needed, however, to involve a wider range of global scientific communities and civil society in the planning of and follow-up to the forum, building on existing mechanisms and intersessional dialogue in online and offline formats. Calls were also made to ensure a deeper collaboration between the Mechanism partners and Member States that are not currently participating in pilot projects on science, technology and innovation road maps for the Goals.

92. While considerable progress has been made in the recent years, science, technology and innovation has not reached its full potential as a tool for Goal implementation due to lack of political will at the national and global levels, funding, conflicts of interests and unclear mandates.

93. Similar challenges apply to the Mechanism itself. To date, key parts of the Mechanism, including the forum, have not received dedicated financial support, which is limiting the scope of its operations.

94. The inter-agency task team and its 10 work streams are mandated to promote coordination within the United Nations system on matters related to science, technology and innovation, and enhancing synergy and efficiency, particularly on capacity-building initiatives. The work streams have carried out useful work, including online training on science, technology and innovation policy design for more than 500 policymakers, and pilot projects on science, technology and innovation road maps for the Goals, but scaling up these efforts is constrained by lack of funding.

95. The 10-Member Group is tasked with supporting the Mechanism, including the forum. The Group discussed its shared vision and high priority actions for the Goals until 2030 and beyond. It emphasized that technological change, science, and innovation are augmenting the world at an increasing speed, but that they are also generating an enormous divide in areas such as digital, educational, and technological

capacities around the world, resulting in inequality and instability. The Mechanism and the forum are well suited for assessing and monitoring these changes and highlighting the areas that need further policy action, investments, and governance structures.

96. The 10-Member Group stressed the importance of strengthening local and national innovation. Such efforts can be complemented through universities and scientific institutions taking an active role in providing support for the existing innovation ecosystems and continuously enhancing innovation skills to extend the knowledge and attract global support, especially to promote sustainable innovation and development in the global South. The 10-Member Group has therefore proposed the creation of a global network of banks of ideas and funds for innovation. Recommendations have also been made for the Mechanism to work more closely with research funders, collaboration that could be facilitated through the Global Research Council, which has funders from more than 55 countries.

97. A proposal was made for the next forum to be held in a low-middle income country.

98. Member States were encouraged to join the Partnership in Action on science, technology and innovation road maps for the Goals and to support the scaling-up of the pilot programme to interested countries. The Partnership is a multi-stakeholder, informal technical group to support the work on the road maps in the Mechanism. It contributes to knowledge-sharing and distribution of lessons learned from the science, technology and innovation road maps for the Goals and contributes to new collaborative projects and partnerships.

### **III. Recommendations for consideration**

99. The forum highlighted many practical examples and proposed recommendations for action, including by the United Nations system, Governments, businesses, scientists, academia and civil society. The necessity of international cooperation in science, technology and innovation and of multi-stakeholder approaches was repeatedly underscored. The issues below may be considered by decision makers, in addition to the wider range of recommendations on how to address the challenges indicated in section II of the present report.

#### **General recommendations**

100. The world is grappling with overlapping challenges such as the COVID-19 pandemic, wars and conflicts, food insecurity, climate change, rising national debts, global supply chain disruptions, biodiversity loss, rising inflation and political mistrust. Such disruptions risk eroding hard-won development gains, while also providing an opportunity for the world to rethink existing development paradigms. Longer-term thinking and planning, backed by scientific knowledge and robust data, is needed to ensure that resources are used for sustainable solutions.

101. While considerable progress has been made in the recent years, science, technology and innovation has not reached its full potential in the context of Goal implementation, including owing to lack of political will, lack of funding and conflicts of interest. The current trends in mainstream investment in the field often support a “winner-takes-all” scenario, in which one innovator prevails. There is a need to ensure more equitable sharing of benefits through new policies, regulation, open access technologies, access to knowledge, data and information, collaboration platforms and governance structures. The forum also heard calls for demonetizing

knowledge generation and strengthening decentralized discovery and manufacturing capacity for diagnostics, therapeutics, vaccines and food security, in order to ensure access, impact, and safety.

102. Science, technology and innovation should be considered as an integral part of countries' national planning, Goal implementation plans and monitoring efforts. The voluntary national reviews presented by the Member States at the high-level political forum on sustainable development offer an integrated way in which to assess each country's overall progress, challenges and opportunities for effective Goal implementation. These reviews should also assess the potential that science, technology and innovation holds for boosting national efforts and to identify next steps.

### **Recommendations on lessons learned from the COVID-19 pandemic**

103. Science, technology and innovation has been in the global spotlight during the COVID-19 pandemic, proving to be one of humanity's most valuable resources for responding to global challenges and advancing the well-being of current and future generations. There is a need to ensure that this momentum is harnessed for further Goal implementation.

104. The pandemic has highlighted the need for just transformations that support sustainable, inclusive and resilient societies. Rising inequalities and new forms of vulnerability that the pandemic has revealed have stressed this need. Now more than ever, it is important to embrace science-informed solutions that are grounded in inclusive and ethical innovation.

105. The pandemic has further highlighted the need for bridging the digital divide, enhancing digital literacy, strengthening national technology, science and innovation systems, breaking down gender barriers and harnessing greater international cooperation and solidarity.

106. The pandemic has further stressed the need for ensuring context-specific solutions that take into consideration the most vulnerable and the marginalized. There is a need for participatory decision-making processes and the co-design of science, technology and innovation policies that engage all population groups, including women and girls, youth, persons with disabilities and indigenous people.

107. The scientific community had earlier raised alarm bells regarding the likelihood of a global pandemic such as the COVID-19 pandemic, and these alarms had too often gone unnoticed. Current global understanding is that the risk for future pandemics remains high. Active learning is needed to ensure that the world and science, technology and innovation systems are fit for future crises, including pandemics. Resilience towards future shocks will also depend on how well the vulnerable and marginalized groups can be empowered to weather these shocks, utilizing science, technology and innovation as one of the tools. The United Nations must be better prepared for future pandemics and for dealing with incomplete and unfinished pandemics and epidemics, as the world's interconnectedness and shared vulnerabilities demand a one-for-all approach based on the principle that no one is safe unless we are all safe.

### **Recommendations for the Technology Facilitation Mechanism**

108. The Mechanism should continue to bring together a wide variety of stakeholders, in line with its mandate, to discuss both the potential of science, technology and innovation and challenges for the Goals. New technologies and the current models of global digitalization raise legitimate questions of transparency, security, trust, privacy, biases, job losses and rising socio-economic inequalities. The Mechanism should serve as the mechanism for acknowledging these concerns and

offer an avenue for an open debate and collaboration to tackle them. It should also serve as the platform for forging new partnerships and scaling up solutions that work in a practical way. In general, the United Nations needs to be further strengthened to fulfil its mandates.

109. The Mechanism can and should facilitate discussions around emerging policy issues related to frontier technologies, their deployment, financing and governance. The forum can provide a platform for discussions on how best to deploy these types of technologies for shared public benefit, and the Mechanism should continue work on these topics between the Forums.

110. The Mechanism should help to raise awareness around emerging technologies, discuss the needs for standards and regulations for their use and also help to ensure that new technologies are promoted in a way that is environmentally, economically and socially sustainable. There is a need to consider how the Mechanism can continue to facilitate these discussions and make linkages with other relevant forums in between sessions of the forum.

111. The global pilot programme on the science, technology and innovation road maps for the Goals has proved useful, and lessons learned from the work in the pilot countries should be widely shared with all Member States. Scaling up of the work could be done jointly with a number of relevant partners facilitated by the Mechanism, in order to ensure wider and lasting impacts.

112. The science, technology and innovation aspects of the Secretary-General's "Our Common Agenda" were widely discussed during the forum. Further consideration should be given as to how the work of the Mechanism and the United Nations inter-agency task team on science, technology and innovation for the Sustainable Development Goals fits into the processes proposed in the report, in order to ensure full compatibility of efforts. The 10-Member Group serves as an active part of the Mechanism and could contribute more directly to various work streams on science, technology and innovation within the United Nations system. In particular, the 10-Member Group has proposed the creation of a global network of banks of ideas and funds for innovation.

113. Synergies between the Mechanism, the forum, the Commission on Science and Technology for Development, the Internet Governance Forum, regional forums on science, technology and innovation, the Global Sustainable Technology and Innovation Community and other relevant events and initiatives should be further enhanced and collaboration strengthened.

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