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Progress made in the implementation of and follow-up to the outcomes of the World Summit on the Information Society at the regional and international levels

Science and technology for development

Report on the intersessional panel meeting

Vienna International Centre, Vienna
15–17 January 2019

Prepared by the UNCTAD secretariat[1]

[1] This report summarizes the intersessional panel's discussions; it does not necessarily reflect the views of the UNCTAD secretariat or of the member States of the Commission on Science and Technology for Development.

I. Introduction

1. At its twenty-first session in May 2018, the Commission on Science and Technology for Development (CSTD) selected the following substantive themes for its 2018–2019 intersessional period:

(a) The impact of rapid technological change on sustainable development;

(b) The role of science, technology and innovation in building resilient communities, including through the contribution of citizen science;

(c) Progress made in the implementation of and follow-up to the outcomes of the World Summit on the Information Society (WSIS) at the regional and international levels.

2. To help address these themes, a panel meeting was organized by the CSTD secretariat in Vienna from 15 to 17 January 2019. The aim of the meeting was to study in depth various issues related to the substantive themes, with a view to contributing to considerations by CSTD at its twenty-second session, to be held in Geneva from 13 to 17 May 2019.

II. Organization of work

3. The panel meeting was attended by members of CSTD and representatives of international organizations, civil society, the technical and academic community and business entities, as well as other observers. The documentation for the meeting included papers prepared by the CSTD secretariat, presentations and policy papers submitted by participants. Meeting documents are available on the CSTD website.[2]

III. Opening

4. The panel meeting was opened by the Director of the Division on Technology and Logistics of UNCTAD and Head of the CSTD secretariat, who reaffirmed the position of CSTD as the leading platform in the United Nations for science policy discourse and its unique role as a multilateral forum for international cooperation, dialogue and the sharing of experiences in science, technology and innovation. She provided updates on the cooperation between the CSTD secretariat and the Government of China aimed at strengthening South–South collaboration in the area of science, technology and innovation, and on the efforts made to strengthen the collaboration between CSTD and the regional commissions of the United Nations and other stakeholders. The Director noted that the workshop on applying a gender lens to science, technology and innovation, co-organized with the Government of Austria and the United Nations Entity for Gender Equality and the Empowerment of Women, to be held on 18 January 2019, supported the gender mainstreaming efforts of CSTD. Finally, she highlighted the importance of the panel meeting in making proposals that would help to ensure that the reports of the Secretary-General on the priority themes were more relevant and action oriented.

5. The Chair of CSTD[3] noted the importance of the panel meeting in providing proposals for consideration at the twenty-second session of CSTD. He provided a briefing on several issues, including the draft resolutions from the twenty-first session, which had been adopted by the Economic and Social Council in July 2018;[4] two resolutions of the General Assembly that concerned the work of CSTD, on the impact of rapid technological change on the achievement of the Sustainable Development Goals and targets and on information and communications technologies for sustainable development;[5] and various

[2] See https://unctad.org/en/pages/MeetingDetails.aspx?meetingid=2026. The panel meeting also included a side event on “50 breakthroughs: Technology for the Sustainable Development Goals”, held on 16 January 2019.

[3] Mr. A. Min Tjoa, Austria.

[4] E/RES/2018/28 and E/RES/2018/29.

[5] A/RES/73/17 and A/RES/73/218.

meetings of the Economic and Social Council and the role played at these meetings by the Chair of the twenty-first session of CSTD and other members of the Bureau.

6. The Deputy Secretary-General of UNCTAD, in her opening remarks, underlined that new technologies commonly associated with rapid technological change, such as artificial intelligence, big data, synthetic biology and nanotechnology, were needed tools to deliver on the 2030 Agenda for Sustainable Development. However, these technologies also posed new challenges for policymakers and society, as they could disrupt economic development, exacerbate social divides and raise ethical questions. Whether rapid technological change would advance or disrupt sustainable development depended on the policies designed, developed and implemented by Member States. In an increasingly globalized economy and digitalized world, only fast and coordinated responses, based on international cooperation and multilateralism, could provide solutions to these challenges. The Deputy Secretary-General emphasized the role of CSTD in advancing collective understanding of how to navigate and shape new and emerging technologies in ways that left no one behind and ensured that science, technology and innovation could be harnessed for and by all.

IV. Theme 1: The impact of rapid technological change on sustainable development

7. The CSTD secretariat[6] presented a paper on the first theme, which highlighted the key issues and challenges with regard to the impact of rapid technological change on sustainable development. New and emerging technologies could support poverty eradication efforts and help monitor sustainable development targets and indicators, improve food security, promote energy access and efficiency, enable structural transformation, support social inclusion, combat disease and enable access to quality education. However, rapid technological change also posed new challenges for policymakers and society. National science, technology and innovation policies could facilitate the harnessing of frontier technologies for sustainable development and help spread capabilities more broadly. In addition to national policies, regional and international cooperation and multi-stakeholder partnerships could advance rapid technological change for sustainable development. The United Nations, including CSTD, had a role to play in supporting capacity-building efforts, technology foresight and assessment and norm-setting and consensus-building.

8. The first panel discussion was moderated by the Chair of CSTD. One speaker[7] discussed the significant progress made in Africa in applying new and emerging technologies to the control of malaria, food production, relevant infrastructure and clean energy provision and information and communications technology-enabled entrepreneurship, along with increasing awareness among Governments and the African Union Commission and through the creation of the African Union High-Level Panel on Emerging Technologies to complete scientific assessment reports and offer policy advice. The High-Level Panel had identified 10 technologies with developmental potential and published three reports, on drones, gene drives and microgrids. Drones could be used for precision agriculture to support real-time decisions, anticipate and adjust agricultural inputs (e.g. water, fertilizer and pesticide treatment) and enable land mapping and surveying. Gene drives were an effective approach to the control and elimination of malaria vectors. Microgrids could empower communities through less capital-intensive and more cost-effective energy access. Emerging technologies required strategic policies in their implementation, including on research, infrastructure, education, regulation, entrepreneurship and communications awareness. Finally, it was important to gain proactive engagement from governments, development partners and the private sector.

[6] Ms. Shamika N. Sirimanne, UNCTAD.

[7] Ms. Yaye Kène Gassama, Cheikh Anta Diop University, Senegal, and African Union High-Level Panel on Emerging Technologies.

9. Another speaker[8] discussed the strategic and policy considerations that could accelerate the development and commercialization of breakthrough technologies for sustainable development. A study on 50 breakthroughs had analysed the critical technology breakthroughs needed to address key areas, including electricity access, education, human rights, water security, global health, digital inclusion, food security, gender equity and climate change resilience. Noting the discovery of the Haber–Bosch process that had enabled the development of fertilizers for a green revolution in South Asia, the speaker stated that highly sophisticated research and development and commercial attractiveness would likely be necessary to create solutions for sustainable development. A long-term solution was to invest in strong research and development capabilities, and medium-term strategies in some countries could include prioritizing strategic sectors related to sustainable development, as well as creating partnerships with the private sector to undertake research and development in key national priority areas.

10. One speaker[9] provided an overview of the impact of rapid technological change on sustainable development, in particular with regard to Goal 9. The future of manufacturing would be shaped by the related technology, policy and development dimensions. With regard to the first dimension, advanced digital and production technologies would enable the transition to smart factories. Policy strategies to promote advanced manufacturing included learning and experimentation, multiple interactions and coordination, converging policy realms (e.g. industrial policy and innovation policy), distributed power and context specificity. Finally, the speaker suggested that an industrial strategy should be conducive to development and tailored to a country's accumulated technological, productive and other required capabilities.

11. Another speaker[10] highlighted how artificial intelligence could be more gender inclusive, how the artificial intelligence sector could benefit from the contributions of women technologists and designers, and how one company, Sage, had developed an artificial intelligence code of ethics. The speaker presented a case study of an artificial intelligence-powered companion for adolescents that provided advice on sexual and reproductive health, whereby ethics was not an afterthought but had been proactively designed as a feature of the intelligent agent. Some machine learning and artificial intelligence algorithms were biased, with higher inaccuracies in facial recognition tasks with regard to people not well represented in the data the models had been trained on. In this regard, the speaker emphasized the need for more inclusive and less biased algorithms, to focus rapid technological change on augmenting human intelligence rather than replacing it, and coordinated solutions to mainstream ethical technologies in companies and across other organizations involved in bringing intelligent technologies to the market.

12. During the ensuing interactive discussion, delegates stressed that rapid technological change required policies and an enabling environment to ensure that its impacts supported sustainable development efforts. Participants deliberated on the meaning of the phrase "rapid technological change", how it might be similar to or different from previous technological eras and how it related to other frequently used terms, including exponential technologies, frontier technologies and industry 4.0. One delegate noted the need to strengthen capacity for technology assessment at the global level, highlighting the lack of capacity in many countries to conduct such exercises. One panellist stated that companies that developed ethical and normative frameworks for development in artificial intelligence encouraged software developers building on their platforms to adopt the same principles. Several delegates noted existing divides with regard to women's participation in rapid technological change, as well as the increasing power of data monopolies that might affect the pace of innovation in companies, communities and countries not already at the technological frontier. With regard to Goal 10, participants noted the contribution of rapid technological change to increasing inequalities and discussed how and to what extent technology transfer and investing in skills could address growing divides. Finally, participants highlighted the need for multi-stakeholder discussions on rapid technological

[8] Mr. Shashi Buluswar, Institute for Transformative Technologies, United States of America.

[9] Ms. Cecilia Ugaz Estrada, United Nations Industrial Development Organization.

[10] Ms. Kriti Sharma, Sage, United Kingdom of Great Britain and Northern Ireland.

change, improved policy coherence across government ministries and greater understanding of the impacts of rapid technological change, in particular with regard to inclusion and diversity.

13. The second panel discussion was moderated by a Vice-Chair of CSTD.[11] One speaker[12] discussed how the sustainable development strategy of Egypt was consistent with the Goals and noted that information and communications technology was a critical enabler of the strategy and the Goals. In addition, the speaker emphasized that the Ministry of Communications and Information Technology promoted rapid technological change and that its pilot telemedicine programme had been scaled up to a national initiative.

14. Another speaker[13] presented the national vision of Latvia for the development of a data-driven nation, including the three pillars of data democracy, data-enabled citizen engagement in public administration processes and data and technology-driven innovation development and commercialization. Key examples of rapid technological change included fifth generation technology installations, machine translation in specific industries, the use of artificial intelligence for the individualized treatment of metastatic melanoma and digital platforms for direct political participation.

15. One speaker[14] discussed the national emerging technologies strategy of Saudi Arabia, involving five technologies (namely, artificial intelligence, robotics, blockchain, virtual reality and augmented reality) and five industries (namely, energy, manufacturing, health care, finance and insurance and public services). The speaker noted that cyberinfrastructure, human capital development and the legislative framework served as enablers of the strategy and the country's involvement in international cooperation on rapid technological change through the International Telecommunication Union and the World Economic Forum.

16. The panel was divided into three discussion groups on the following sub-themes: leaving no one behind; national policies and strategies for rapid technological change; and international and multi-stakeholder cooperation (see annex I). Each sub-theme discussion was chaired by an expert speaker, who reported the group's findings to the plenary. The main points raised by participants in the group discussions are highlighted in the following paragraphs.

A. Leaving no one behind

17. The group discussed the prospects for ensuring inclusion and mitigating inequality in the context of rapid technological change, and how interventions to solve problems might be important but unsustainable, owing to difficulties in facilitating cultural shifts or challenges associated with inadequate technological capabilities. Recommendations for action included developing the human element, with special attention to investing in women and girls; helping communities identify their own problems; raising awareness of technologies and building skills so that communities could use them; building partnerships with all stakeholders, including governments, academia, the private sector and civil society; designing technological solutions based on innovations; and considering return-on-investment models to support sustainability and scaling up. The group noted that interventions to solve problems might also create other problems. In this regard, it was important to consider local cultures, customs, norms and traditions, to learn from best practices, to use nuanced, contextual approaches and to provide simple solutions, knowledge and information to communities. The group discussed how some development interventions focused on efficiency rather than inclusiveness and suggested that interventions should also consider excluded communities in present and future programmes. Finally, the group identified good governance and open dialogue with regulators and decision makers as a challenge, in particular with regard to intellectual

[11] Mr. Kekgonne Baipoledi, Botswana.
[12] Representative of Egypt.
[13] Representative of Latvia.
[14] Representative of Saudi Arabia.

property rights and technology transfer. Some suggestions in this regard were to balance intellectual property rights and development for pro-poor access, encourage multi-stakeholder collaboration, encourage South–South and triangular cooperation and prevent illicit financial flows.

B. National policies and strategies for rapid technological change

18. The group found that there was no standard set of national policies to harness the benefits and mitigate the challenges of rapid technological change across all countries. Rather, it was important to share best practices and lessons learned on how such policies and strategies were designed and implemented, whether they were linked to strategic sectors in the economy, who developed such policies (e.g. a ministry of information and communications technology or of science, technology and innovation) and how strategies differed in developing and developed countries. The group affirmed the need for technology foresight on rapid technological change to understand the impacts of applying new and emerging technologies in dominant sectors of a national economy, as well as to assess potential implications for social inclusion and environmental sustainability. In some countries, national foresight exercises were conducted in collaboration with the Government, academia and the private sector, with a focus on specific technologies. Finally, the group noted the importance of governments and policymakers in guiding the development of rapid technological change to safeguard against socioeconomic risks, prepare the population for the digital and non-digital skills required in future occupations and mitigate a widening digital divide.

C. International and multi-stakeholder cooperation

19. The group discussed how the international community could support rapid technological change for sustainable development through multilateral and multi-stakeholder initiatives, as well as regional and international cooperation. The group agreed that the fragmentation of science, technology and innovation for development efforts across the United Nations system and the international community was a challenge, and recommended taking advantage of various existing platforms to provide policy support for rapid technological change and better coordination, communications and synergy across United Nations mechanisms related to science, technology and innovation, starting with logistical and scheduling concerns. In addition, the group highlighted the limited awareness of the work of CSTD in the United Nations system, and noted that CSTD provided a unique perspective incorporating science, technology and innovation policy, as well as a gender lens involving innovation and development, adding value to the intellectual and policy research outputs of various agencies and organizations; conducted science, technology and innovation policy reviews that were excellent examples of deep dives into a national science, technology and innovation context, with proposals for strengthening national systems of innovation; and served as a knowledge bank and platform within the United Nations system, providing policy and political guidance on science, technology and innovation for development. Finally, the group noted the emerging discussions at the national and international levels of the normative, ethical and regulatory considerations brought about by existing and new and emerging technologies.

V. Theme 2: The role of science, technology and innovation in building resilient communities, including through the contribution of citizen science

20. The CSTD secretariat[15] introduced a paper on the second theme, which highlighted key issues, challenges and opportunities in the use of science, technology and innovation in building resilient communities. A new development, citizen science, used new technologies

[15] Ms. Shamika N. Sirimanne, UNCTAD.

to engage volunteers in carrying out tasks such as data collection in support of science. Technical, social and market-related challenges were related to the prudent use of data and underlying enabling technologies; knowledge generation and use; and scalability and sustainability. Another key issue was the need to develop science, technology and innovation solutions that were resilient in themselves, given that disruptions could be harmful to communities. Governments were encouraged to support the use of science, technology and innovation to build resilience by promoting science, technology and innovation-related skills and education and developing the required infrastructure and regulations.

21. The first panel discussion was moderated by the Chair of CSTD. One speaker[16] highlighted how citizen science could contribute to building resilient communities, focusing on recent experiences from Japan, and suggested that science and technology groups should work together and have a common voice to better communicate with citizens. The Japan Academic Network for Disaster Reduction had been established in cooperation with the Science Council of Japan as a network of academic societies related to disaster prevention, mitigation and recovery. It was important to integrate community resilience-building activities into government policy frameworks. A community disaster management plan had been established in 2014 to promote the development of community-based disaster management plans integrated into municipal-level plans, and more than 2,700 communities in Japan were active in developing their plans.

22. Another speaker[17] highlighted the application of geospatial technology in building resilience and the importance of considering who controlled the knowledge generated through such applications and which values were at stake. Resilience was a prominent value, along with others such as security, equity, privacy, accountability, sustainability and transparency. Geospatial technology served as a problem solver in cases in which there was consensus regarding values and certainty related to the knowledge to be applied. For other types of policy problems, geospatial technology could be used in the mediation of debates and in analysis, to reduce knowledge uncertainty, or to better recognize problems in the first place. A critical consideration in the use of geospatial technology was that such applications generated considerable information about users, and data privacy therefore needed to be ensured. Finally, the speaker suggested that debates should be held related to the context of and consent for data collection, who controlled access to original data and derived products and how to ensure accountability.

23. One speaker[18] highlighted the importance of promoting indigenous knowledge to build community resilience. Such knowledge was used by communities to cope with economic, political and environmental shocks, and was integral to community identity. Indigenous knowledge was not static, but continued to evolve throughout generations, based on a community's needs. For example, indigenous and local communities had bred 2.1 million varieties of over 7,000 domesticated plants worldwide, domesticated at least 34 livestock species and bred over 8,000 rare breeds of these species. This diversity was used as a source of diet diversity and broad agronomic applications, as well as resistance to pests and diseases. There was a need to recognize that this source of knowledge was on par with others, and provide an enabling environment through policies and regulations and institutional support for scouting, producing, sustaining and scaling up grass-roots innovations. In addition, there was a need to recognize and protect the rights of local and indigenous communities to land and resources.

24. Another speaker[19] noted that citizen science was a new way to engage citizens in understanding global environmental challenges, providing data for policies to address them and helping society to manage the associated risks. Citizen science was cheaper, quicker, more agile and accurate and could deliver data sets with higher granularity than traditional methods. Associations for the promotion of citizen science had been established in many

[16] Ms. Setsuko Saya, Cabinet Office, Government of Japan.
[17] Ms. Yola Georgiadou, University of Twente, Netherlands.
[18] Ms. Neth Daño, ETC Group, Philippines.
[19] Mr. Martin Brocklehurst, Policy Working Group, European Citizen Science Association, United Kingdom.

countries and regions (e.g. the Citizen Science Global Partnership and the Global Mosquito Alert). The speaker stated that it was time for business and commercial partners to get involved and to share the costs and benefits, and suggested that the United Nations could put in place an institutional framework to embed citizen science into all relevant areas of its activities and enable the use of citizen science data in the scope of official statistics and reporting and decision-making processes related to the Goals.

25. A video message regarding citizen science in the Pacific Community[20] emphasized the link between citizen science and traditional knowledge.

26. During the ensuing interactive discussion, delegates noted the growing emphasis on active scientific citizenship as a key building block of scientific and technological literacy, as well as some of the factors that affected the sustainability of citizen science projects, including the alignment of the interests of scientists and citizens in a project and the proper provision of feedback to citizens to keep them engaged. Delegates provided national examples of public policy to promote citizen science. With regard to indigenous knowledge, delegates noted the importance of combining different sources of knowledge to provide useful solutions for building resilient communities, and provided examples of national programmes in support of indigenous knowledge, including initiatives to employ indigenous people to monitor ecological health, maintain cultural sites and protect sensitive areas and species in indigenous territories.

27. The second session, on country case studies, was moderated by a Vice-Chair of CSTD.[21] One speaker[22] presented some of the main messages of the Science Forum South Africa, held in December 2018 in Pretoria, and noted that resilience-building efforts required more inclusive institutions for scientific research and knowledge production that involved a broader set of stakeholders, valued different types of knowledge and addressed the needs of the entire population. Building resilience in urban regions was increasingly important, as cities were areas of rapid technological change and population growth. In addition, the resilience of agriculture in Africa was threatened by population growth, climate change, global warming and water scarcity, and biotechnological tools such as gene editing provided new opportunities to improve agricultural productivity. However, there was a need to assess the benefits and risks of such technologies and to investigate how existing regulatory contexts and frameworks enabled experimentation and deployment in this regard.

28. Another speaker[23] noted that the United Nations Educational, Scientific and Cultural Organization had recently launched the Global Observatory of Science, Technology and Innovation Policy Instruments platform, which could serve as an additional tool to support the use of science, technology and innovation in building resilient communities. The platform had information on 55 countries related to science, technology and innovation policies, policy instruments and legislation, among others, in particular science, technology and innovation policy instruments on resilience, as well as on open science, including citizen science. An important component of citizen science initiatives was schools and the broader education sector, as seen with regard to the Sandwatch initiative of the United Nations Educational, Scientific and Cultural Organization, focused on the sustainability of beaches.

29. One speaker[24] highlighted the Traditional Knowledge Digital Library in India as a pioneering initiative to prevent the misappropriation of national traditional medicinal knowledge. With regard to resilience, India aimed to give a greater role to women in disaster risk management, develop a network of universities to work on disaster-related issues, use social media and mobile technologies as tools in disaster risk reduction and focus on building local capacity and initiatives to enhance disaster risk reduction. Despite the important role of citizen science, awareness of the subject was in its infancy. Discussions on citizen science and its applications needed to be institutionalized, such as

[20] Mr. Colin Tukuitonga, Pacific Community, Niue.
[21] Representative of the Dominican Republic.
[22] Mr. Kekgonne Baipoledi, Botswana.
[23] Mr. Ernesto Fernandez Polcuch, United Nations Educational, Scientific and Cultural Organization.
[24] Representative of India.

through the organization of an annual global event on citizen science or a global platform to share experiences.

30. Another speaker[25] noted the role of public service broadcasters in raising awareness and promoting the engagement of the public in citizen science. For example, the British Broadcasting Corporation had launched initiatives to help citizens, including those with mobility issues or who were homebound, participate in scientific projects and surveys, in order to contribute to resilient communities, such as by launching a pandemic application in 2017, aimed at helping people prepare for a flu pandemic and researchers to study how pandemics spread.

31. During the ensuing interactive discussion, delegates noted ways to institutionalize citizen science and promote linkages between conventional science and citizen science. Some participants suggested encouraging the Organization for Economic Cooperation and Development to include the topic of citizen science and traditional knowledge in its *Oslo Manual: Guidelines for Collecting, Reporting and Using Data on Innovation*. Other participants noted that as citizen science could be cheaper, quicker and more agile and accurate than traditional methods, the least developed countries could use it as an efficient tool, and suggested that the Technology Bank for the Least Developed Countries create and support programmes on citizen science.

32. The panel was divided into three discussion groups on the following sub-themes: science, technology and innovation for community resilience; the role of citizen science in building community resilience; and interregional and international cooperation (see annex II). Each sub-theme discussion was chaired by an expert speaker, who reported the group's findings to the plenary. The main points raised by participants in the group discussions are highlighted in the following paragraphs.

A. Science, technology and innovation for community resilience

33. The group noted that one of the challenges in implementing projects to build community resilience that used new technologies involved changing mindsets and attitudes towards science, technology and innovation and institutions. The group agreed that to change mindsets, policymakers needed to communicate with communities in local languages, respect local cultures and identify and work with key leaders as champions. To increase understanding and appreciation for science, it was important to showcase good examples at local levels and adopt measures to prevent the misuse of citizen science. To address challenges related to human resources, the group recommended that countries explore models of volunteerism. To link research and development with commercialization, policymakers could provide platforms for industry, civil society, academia and entrepreneurs to interact. Sharing knowledge and experience between countries could help improve outreach efforts in bringing science, technology and innovation to marginalized groups through grass-roots actors and initiatives. Finally, the group discussed how science, technology and innovation initiatives could be sustainable in the longer term, and suggested that policymakers should integrate science, technology and innovation into education systems and national investments and better manage citizen science expectations.

B. The role of citizen science in building community resilience

34. The group discussed policies, projects and initiatives aimed at using and promoting citizen science to build resilient communities, including how such projects incorporated a gender approach and the main challenges in implementation. The group agreed that significant challenges included scaling up projects and addressing data privacy and ethical issues, data quality and the need for standards, along with resistance from the scientific community to engage with citizens and an absence of high-level political buy-in. The group discussed the policies needed to support citizen science projects, with a focus on developing country contexts, and noted the importance of information and communications

[25] Representative of the United Kingdom.

technology infrastructure as an enabling technology; involving civil society; and identifying community needs and aligning citizen science with policy aims. The group recommended that CSTD consider citizen science in discussions on priority themes.

C. Interregional and international cooperation

35. The group noted that traditional areas of collaboration were in hazard monitoring and awareness-raising activities regarding disaster risk reduction. Regional and international cooperation usually aimed to address common and cross-border risks, and focused on the production of regional and global public goods, including the sharing of data. The group discussed potential new mechanisms and areas of collaboration to scale up innovations for community resilience. Effective forms of international cooperation should aim to address specific problems, for which stakeholders had reached consensus on shared values and for which there was clear supply and demand for science, technology and innovation solutions. The group suggested encouraging existing platforms for technology facilitation and transfer to include such solutions to build resilience and encouraging the online platform of the Technology Facilitation Mechanism to share good practices and concrete examples of collaboration on science, technology and innovation for resilience. The group suggested that CSTD further consider the definition and examples of citizen science and associated concepts such as open science, as well as issues related to data privacy.

VI. Progress made in the implementation of and follow-up to the outcomes of the World Summit on the Information Society at the regional and international levels

36. This panel discussion was moderated by a Vice-Chair of CSTD.[26] Participants considered the linkages between the WSIS process and the 2030 Agenda, in particular in terms of the gaps between and within countries, given the pledge that no one will be left behind.

37. One speaker[27] highlighted the current state of play in implementing WSIS outcomes. Since the first WSIS, 15 years had passed, and there had been rapid and significant progress in the development of and access to infrastructure related to the information society. The information society had been contributing to sustainable development through specific applications in sectors such as health and education; more effective, efficient and inclusive methods of functioning; and societal changes in interactions. However, the information society might not be as people-centred, inclusive and development-oriented as WSIS participants might have hoped. CSTD had identified some challenges related to the information society that could act as framing issues for assessing progress, namely, challenges related to access, inclusiveness and equality; concerning trust and security; and in looking beyond the digital sector alone to the impact of digitalization on society. The development of information and communications technology would continue to accelerate in the future and concerned the overall digitalization of the economy, society and culture and a wide range of digital technologies. Therefore, the speaker noted that to assess progress, stakeholders needed to consider the development of the information society within the context of broader economic, social and cultural development.

38. Another speaker[28] presented International Labour Organization research on the future of work, in particular workers engaging with digital labour platforms. The speaker noted that the focus of research in this area was on social justice, decent work deficits, inequalities and the human conditions of work, and considered what could be done, from the perspective of governments, employers and trade unions, to shape the future of work. The speaker focused on the results of a recent International Labour Organization survey

[26] Mr. Peter Major, Hungary.
[27] Mr. David Souter, ICT Development Associates, United Kingdom.
[28] Mr. Damian Grimshaw, International Labour Organization.

conducted among workers using microtask platforms. At present, government regulation of crowd work platforms did not exist. Rules were defined by the platforms, and the evidence suggested that there was a deficit of decent work. The speaker highlighted some policy instruments that could make microwork fairer, including ensuring workers' rights, creating codes of conduct for platforms, providing psychological protection and social insurance and improving communications between platforms and workers.

39. One speaker[29] detailed work related to the implementation of WSIS outcomes carried out by the International Telecommunication Union. With regard to the WSIS implementation process, the speaker highlighted the importance of providing relevant inputs on best and emerging practices at the national, regional and global levels, and encouraged participants to contribute to the process. The speaker noted the efforts of the International Telecommunication Union to improve the availability of data on the information society and its mapping tool for the Goals. Events prior to and during WSIS Forum 2019 would include a celebration of the tenth anniversary of the WSIS Forum, open consultations, prizes and special tracks on virtual reality for the Goals, innovation and youth, among others, as well as a hackathon and an accessibility day.

40. Another speaker[30] described a platform in Uganda, Akello Banker, that allowed local communities to integrate different solutions into the platform. Around 60,000 farmers and traders used the platform to access products and services on credit and to effectively manage operations and track credits digitally, and around 12,000 households used it to obtain access to grocery products and medical services or to acquire digital skills. The platform offered easy access to such products and services by leveraging technology and partnerships with local service providers, who offered structured repayment plans tailored to user needs. The platform was accessible online and through mobile applications, short message services and unstructured supplementary service data. Finally, the speaker noted that accessibility, inclusion and convenience had been key factors in the success of the platform.

41. One speaker[31] described the Internet Governance Forum held in Paris in November 2018. Forum participants had recognized the rapid evolution of the Internet and the significant potential of new technologies to bring growth and benefits to all. The speaker detailed the main themes of the Forum in 2018 and its outcomes and noted a request for issues, in order to better understand which themes or topics the broader Forum community wished to see discussed at the next Forum, to be held in Germany in November 2019. The speaker also presented a promotional video.

42. During the ensuing interactive discussion, delegates debated which tasks were less likely to be automated and noted the efforts of the International Labour Organization in the area of the future of work. One delegate stated that the WSIS Forum and Internet Governance Forum in 2020 could use their multi-stakeholder platforms to prepare an evaluation before the review of the implementation of WSIS outcomes in 2025. Delegates agreed that although the original WSIS goals and action lines might seem outdated, a people-centred and inclusive information society was still a relevant issue and that some of the challenges remained to be addressed. One delegate suggested holding a world summit at the highest level to develop a new outcome document. Participants discussed how the Internet Governance Forum could attract a more diverse group of stakeholders, in terms of both geographical diversity and industries not currently engaged in the process, such as banking, aviation and automobiles. One delegate noted the need for a single platform for countries to discuss Internet governance issues. Several participants highlighted that affordability remained a key issue that needed to be overcome, to address the lack of connectivity worldwide, in particular in small island developing States and the least developed countries. Finally, delegates discussed how the WSIS Forum could highlight good practices emerging from the candidates for the WSIS prizes.

[29] Mr. Catalin Marinescu, International Telecommunication Union.

[30] Mr. Jean Anthony Onyait, Akello Banker, Uganda.

[31] Mr. Chengetai Masango, Internet Governance Forum secretariat.

VII. Preparation for the twenty-second session of the Commission

43. The Minister for Education, Science and Research of Austria noted that Austria had been a member of CSTD continuously since its creation and that this was the second time Austria had hosted an intersessional panel. The topics of CSTD were relevant for Austria, as science and research were important foundations of economic and industrial success and societal and regional development. However, an adequate economic and financial framework was also needed to create prosperity. The combination of education, science and research and an economic and financial framework had helped Austria turn into a knowledge society and an economically prosperous society. The Minister noted that education, science and research should be closely connected to the economic structure of a country. In this regard, Austria invested significantly in science and research, at up to 3.5 per cent of its gross domestic product. The Minister concluded by noting the efforts made by Austria in science diplomacy, including successful programmes such as the Association of Southeast Asian Nations–European Academic University Network.

44. One speaker[32] noted that the High-level Panel on Digital Cooperation of the Secretary-General of the United Nations had been created to advise on how the relationship between humanity and technology could be addressed. The report of the High-level Panel would focus on three major issues, namely, the values that digital cooperation should aspire to; the principles that digital cooperation should follow; and how to apply these values and principles. There was relative agreement on the values and principles, but the major challenge was to translate the principles into practical steps and address related concerns. The secretariat was carrying out wide consultations aimed at outlining the functions that digital cooperation should have. The speaker noted that the High-level Panel would meet to discuss these issues and that its report would be presented to the Secretary-General by the end of May 2019.[33]

45. Another speaker[34] introduced the history of and current perspectives on information processing. For example, in the 1950s, some people had thought that computers would be used only for research and science. Now, the era of industry 4.0 involved smart manufacturing based on the use of software, information technology and information and communications technology. Objects were interconnected and individuals shared all sorts of information and data that were used by different businesses. Finally, the speaker discussed whether artificial intelligence had the potential to take over different roles and jobs and what kinds of jobs it might help create.

46. The Chair of CSTD presented closing remarks and concluded the intersessional panel meeting.

VIII. Findings and suggestions

47. The following findings and suggestions were highlighted at the panel meeting and put forward for consideration by CSTD at its twenty-second session.

A. The impact of rapid technological change on sustainable development

1. Main findings

48. Rapid technological change holds the potential to help achieve the 2030 Agenda and the Sustainable Development Goals. Yet rapid technological change also poses new challenges for policymaking, threatening to outpace the capacity of governments and society to adapt to the shifts brought about by new technologies. However, although the global dynamics of technological change have the potential to increase socioeconomic

[32] Mr. Jovan Kurbalija, High-level Panel on Digital Cooperation secretariat.

[33] A discussion on the High-level Panel on Digital Cooperation took place during a workshop organized on 17 January.

[34] Mr. Michael Hinchey, International Federation for Information Processing.

divides, policies can support investments that spread capabilities more broadly and stimulate innovation with and for groups at the margins of society. National strategies harnessing rapid technological change for sustainable development involve building and managing effective innovation systems. North–South, South–South and triangular cooperation, initiatives by academic, technical, business and civil society communities and United Nations system-wide efforts can also play a role in ensuring that rapid technological change leaves no one behind. The international community is encouraged to advance its collective understanding of how to navigate and shape new and emerging technologies in ways that leave no one behind. This should involve discussions on international technology assessment and foresight and consensus-building on normative and ethical guidelines to shape the developmental potential of rapid technological change.

2. Suggestions

49. Member States may wish to consider the following courses of action:

(a) Increase national support for research and development activities with regard to rapid technological change and bring together governments, academia, the private sector and civil society to take part in these activities, from basic research to implementation;

(b) Ensure coherence between science, technology and innovation policies and strategies on rapid technological change and the broader national development agenda;

(c) Recognize and consider the social and cultural contexts of local groups, in particular with regard to women, and support the innovation, scaling and deployment of rapid technological change in such contexts;

(d) Promote North–South, South–South and triangular partnerships on rapid technological change and investigate collaborative research and development mechanisms that might be effective for technology facilitation;

(e) Conduct technology assessment and foresight exercises in order to encourage structured debate among all stakeholders towards creating a shared understanding of the implications of rapid technological change;

(f) Apply a gender lens in science, technology and innovation policies, including by promoting and leveraging science and technology to support women's development in key sectors involving rapid technological change. Polices should also promote gender equality in science and technology-related education, careers and leadership and encourage and support the role of women in innovation.

50. The international community may wish to consider the following courses of action:

(a) Work toward defining an international technology assessment and foresight mechanism that would help developing countries assess the immediate and long-term implications of technological change;

(b) Explore how the normative challenges raised by rapid technological change can be considered in an inclusive global discourse consistent with the 2030 Agenda;

(c) Encourage international science, technology and innovation collaboration in rapid technological change;

(d) Foster closer collaboration between different international organizations and with civil society organizations regarding initiatives that aim to build skills for rapid technological change;

(e) Promote the use of digital methods, such as online platforms, for international knowledge sharing and capacity-building.

51. The intersessional panel encourages CSTD to take the following courses of action:

(a) Support multi-stakeholder collaboration in policy learning, capacity-building and technology development;

(b) Improve coordination among stakeholders and enable partnerships in rapid technological change that harness the specific expertise and interest of stakeholders;

(c) Encourage the sharing of lessons between countries and regions, while recognizing that policies and policy mixes cannot be simply transplanted from one context to another;

(d) Compile and share examples of good practices and lessons learned in mainstreaming a gender perspective into science, technology and innovation policies and programmes, with a view to replicating and scaling up successes, and increase collaboration with the Commission on the Status of Women.

B. The role of science, technology and innovation in building resilient communities, including through the contribution of citizen science

1. Main findings

52. Science, technology and innovation play a critical role in building community resilience. Diverse fields of science generate new knowledge that improves understanding of the mechanisms and drivers of community resilience. New market-ready technologies create innovative opportunities for increasing economic, social and environmental resilience. In addition, new approaches to innovation can bring together non-traditional innovation actors to unite their efforts and pool their resources towards building community resilience.

2. Suggestions

53. Member States may wish to consider the following courses of action:

(a) Fully support the development of science, technology and innovation solutions for building resilience, including by advancing the implementation of the 2030 Agenda and the Sendai Framework for Disaster Risk Reduction 2015–2030, as well as the achievement of the Goals;

(b) Design and implement science, technology and innovation policies that contribute to building resilient communities, including by creating an enabling environment for a mission-driven innovation system for resilience;

(c) Align science, technology and innovation policies with public health, disaster management and other relevant policies to make them responsive to building resilient communities;

(d) Adopt inclusiveness in formulating science, technology and innovation for resilience strategies. Science, technology and innovation-related solutions for building community resilience should be inclusive, engaging the participation of the poorest and most vulnerable. It is crucial to support the participation of local communities as co-creators of related innovations, including social innovations;

(e) Establish or strengthen existing national platforms to ensure the more effective use of science, technology and innovation to build resilience;

(f) Strengthen research programmes concerning root causes, mechanisms and drivers affecting the use of science, technology and innovation in building community resilience, to better guide effective science, technology and innovation-enabled interventions;

(g) Promote the use of scientific tools to provide and share risk-related information at different scales before, during and after shocks, to increase resilience through improved preparedness and strengthened capacity to cope;

(h) Invest in enabling technology infrastructure such as information and communications technology and electricity, with a specific emphasis on ensuring affordable access and overcoming geographical, gender-related, generational and income-related digital divides.

54. The international community may wish to consider the following courses of action:

(a) Promote and implement participatory research methods and interdisciplinary and transdisciplinary scientific collaboration for increasing understanding of community resilience, taking into consideration integrated disaster reduction and sustainable transformations;

(b) Take into account and systematically use traditional, local and indigenous knowledge as a part of scientific research focusing on community resilience;

(c) Develop an analytical framework for factoring natural hazard-triggered technological disaster event risks into strategies for building resilient communities;

(d) Leverage private sector participation in the innovation cycle for the creation of new products and services for community resilience;

(e) Use mechanisms such as incubators, accelerators, innovation labs and marketplaces, as well as inclusive, grass-roots and social innovations, to promote the creation of new products and services for community resilience;

(f) Promote an open dialogue on resilience between scientific and technological sectors and policymakers, facilitating networking between them and creating and implementing a systematic framework under which resilience-related issues are taken into consideration as a part of planning and development based on scientific evidence;

(g) Promote citizen science initiatives and building the capacity of communities and citizens to collect, use and analyse data, through budget allocation, programme and project planning and execution and the dissemination of citizen science outcomes in global forums;

(h) Embed citizen science in the standard modalities to support policymaking processes through the application of science;

(i) Promote the use of data acquired as part of citizen science initiatives in ways that respect citizens' rights, in particular privacy rights;

(j) Promote the establishment of platforms for the coordination and compilation of data collected in citizen science projects, so that the data may be available for use in other development-related initiatives;

(k) Establish linkages, programmes and projects between citizen science and the Goals, including those related to building resilience, in line with the priorities of vulnerable communities;

(l) Ensure that science, technology and innovation for resilience and citizen science projects are documented and their results are available in the public domain to facilitate community learning in other settings.

55. The intersessional panel encourages CSTD to take the following courses of action:

(a) Facilitate bilateral and multilateral North–South and South–South partnerships that help to build capacity for science, technology and innovation for resilience, including through citizen science;

(b) Promote various types of effective science, technology and innovation for resilient communities, sharing practical and advanced science, technology and innovation-based resilience experiences, cases and successful paradigms through various forms of international collaboration and exchange activities;

(c) Promote citizen science, including by using it as a perspective from which to contribute to priority themes;

(d) Guide the global community to adopt policies and strategies that encourage women and youth to participate in innovation approaches towards resilience, including through citizen science.

Annex I

Group discussion on the impact of rapid technological change on sustainable development

Sub-theme 1: Leaving no one behind

- How is rapid technological change contributing to inclusive sustainable development, particularly for the poor?
- In what ways can rapid technological change increase socioeconomic and technological divides within and between countries?
- How can we ensure that underrepresented communities benefit from and participate in the development, design and adaptation of new and emerging technologies?

Sub-theme 2: National policies and strategies for rapid technological change

- Does your country have a national policy or strategy on rapid technological change, industry 4.0 or a related theme? What are best practices and lessons learned in devising and implementing such a strategy?
- What is the role of technology assessment and foresight in your country or region with regard to rapid technological change?
- With regard to the potentially disruptive effects, what are examples or best practices of different interventions to navigate rapid technological change?

Sub-theme 3: International and multi-stakeholder cooperation

- How can the international community, including the United Nations, engage in discussions about the ethical implications and normative frameworks guiding the development of rapid technological change?
- What are case studies and best practices of multi-stakeholder cooperation within and between countries to harness rapid technological change for the Goals?
- How can CSTD continue to engage in global technology assessment and foresight, as well as consensus-building, on issues of rapid technological change and sustainable development?

Annex II

Group discussion on the role of science, technology and innovation in building resilient communities, including through the contribution of citizen science

Sub-theme 1: Science, technology and innovation for community resilience

- Can you give examples of projects or policies in your country aimed at using science, technology and innovation to build resilient communities? What are the main challenges confronted while trying to implement these projects or policies in your country or region?
- What are the opportunities and challenges in research and innovation for building resilient communities? What types of competencies are needed at the local and national levels to use, adopt, adapt and maintain science, technology and innovation solutions for community resilience? What is the role of the private sector, civil society and indigenous communities?
- What have been the most effective policy instruments and policy mixes supporting research, innovation and the wider diffusion of technology for community resilience?

Sub-theme 2: The role of citizen science in building community resilience

- Can you provide examples of policies, projects and initiatives aimed at using or promoting citizen science to build resilient communities? Do these projects incorporate a gender approach? What are the main challenges confronted in implementing these projects?
- How are new technologies facilitating or could facilitate citizen science for resilience-building?
- Which policies are needed to support citizen science projects with a focus on developing country contexts?

Sub-theme 3: Interregional and international cooperation

- What has been your experience in interregional and international collaboration in the area of science, technology and innovation for community resilience? Could you give concrete examples of effective mechanisms of collaboration?
- What could be new mechanisms and areas of collaboration (including public–private partnerships) to scale up innovations for community resilience?
- What are the actions that the international community, including CSTD, can take to leverage the potential of science, technology and innovation in building resilient societies, including through the contribution of citizen science?