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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*

Palais des Nations, Geneva

7–8 November 2019

Prepared by the UNCTAD secretariat

* This report summarizes the intersessional panel's discussions. The findings, interpretations and conclusions expressed herein are those of the author(s) and do not necessarily reflect the views of the United Nations or its officials or Member States. This document has not been formally edited.

I. Introduction

1. At its twenty-second session in May 2019, the Commission on Science and Technology for Development (CSTD) selected the following substantive themes for its 2019–2020 intersessional period:

(a) Harnessing rapid technological change for inclusive and sustainable development;

(b) Exploring space technologies for sustainable development and the benefits of international research collaboration in this context;

(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, the CSTD secretariat organized a panel meeting in Geneva from 7 to 8 November 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-third session, to be held in Geneva from 23 to 27 March 2020.

II. Organization of work

3. The panel meeting was attended by members of CSTD and representatives of international organizations, civil society and the technical and academic community, 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.¹

III. Opening

4. The panel meeting was opened by the Chair of CSTD,² who noted the importance of the panel meeting in providing proposals for consideration at the twenty-third session of CSTD. He provided a briefing on several issues, including the draft resolutions from the twenty-second session, which were adopted by the Economic and Social Council in July 2019,³ and various meetings of the Economic and Social Council and the General Assembly. These included the high-level segment of the Economic and Social Council and the Second Committee, and the role played at these meetings by the Chair of the twenty-second session of CSTD and the CSTD secretariat.

5. The Deputy Secretary-General of UNCTAD, in her opening remarks, underlined the deep commitment to harness science and technology as a critical enabler of sustainable development in the spirit of multilateralism and international cooperation. She underlined the potential of innovative business models, including technological innovations, aimed at the financial system, which could contribute to achieving sustainable development. Those models could contribute to providing inclusive and sustainable services for low-income customers. Technological innovations were not only changing the current world but could continue to change it in the future in a profound manner. She added that there was need to work on the checks and balances to limit the scope of abuse of power. She also noted the importance of addressing the ethical treatment of personal information and the importance of promoting collaboration to maximize the benefits of frontier technologies. Also, she underlined the potential benefits of novel applications in space technologies for development. They included applications aimed at building resilience and reducing exposure to disaster, monitoring health risks and supporting infrastructure mapping and

¹ See <https://unctad.org/en/Pages/CSTD.aspx>. The panel meeting also included a side event entitled “Space applications for sustainable development: Copernicus and Crop Watch in action”, held on 7 November 2019.

² Mr. Kekgonne Baipoledi, Botswana.

³ E/RES/2019/24 and E/RES/2019/25.

monitoring. Those technologies were driving down the costs of using, adopting and adapting space technologies. The Deputy Secretary-General emphasized the importance of promoting policies aimed at overcoming the bottlenecks in the area, such as increasing public awareness of space technologies and building capabilities. She concluded by noting that, despite the important progress made in the access, use and applications of information and communications technologies (ICTs), much needed to be done to ensure that ICT applications were available to all. In that context, she noted that the CSTD was a major platform to use and strengthen digital cooperation for development.

IV. Theme 1: Harnessing rapid technological change for inclusive and sustainable development

6. The Head of the Science, Technology and ICT Branch of UNCTAD⁴ presented an issues paper on the first theme, which highlighted the key issues and challenges for harnessing rapid technological change for inclusive and sustainable development. Technological change could increase inequalities through unequal access to new technologies, biased design, automation of tasks, market concentration, and widening the technological gap between countries. Private sector contributions were important to assist Governments and the international community in addressing those new challenges. Elements, characteristics and patterns of inclusive and sustainable business models were presented, which place poverty alleviation and environmental sustainability at the core of their business idea, while the challenges of those business models to reach the extreme poor were also outlined. The speaker stressed the significant potential for the development of innovative and sustainable business models. National science, technology and innovation policies could create an enabling ecosystem and provide directionality for harnessing rapid technological change for sustainable and inclusive development. Such policies should focus on developing national strategies for frontier technologies, building technical skills, conducting technological foresight and supporting networks among firms. In addition to businesses and national policies, international collaboration was crucial for harnessing rapid technological change for inclusive and sustainable development. The international community should support research and science cooperation, capacity-building efforts with regard to technical skills among populations and Governments and official development assistance directed towards areas related to science, technology and innovation.

7. The panel discussion was moderated by the Chair of CSTD.⁵ The first speaker⁶ shared the experience of the Islamic Republic of Iran in designing and implementing a science, technology and innovation policy framework for harnessing rapid technological change for inclusive and sustainable development. The two theoretical priority areas of the policy were developing absorptive capacity through endogenous science, technology and innovation capability and technological learning through learning by doing, using and interacting. The policy was based on three building blocks, which included a sustainable development-oriented national foresight programme, a restructured and enhanced innovation ecosystem and a regulatory system to harness new technologies. The national foresight programme set priorities in Sustainable Development Goal-related areas, such as energy, waste and water management, agriculture and social innovation, and promoted an innovative start-up culture by drawing on experiences from international business models in the identified priority areas. The innovation ecosystem was focused on developing human capital through innovation centres and accelerators and on mobilizing financial resources through venture capital mechanisms. The regulatory changes supported start-ups to diffuse innovation in society and encouraged conventional industries to innovate.

8. Another speaker⁷ presented the business model of Mobihealth International, a fully integrated telehealth company from Nigeria. Mobihealth was an example of how to leverage technology in health-care provision for developing countries. The health-related

⁴ Mr. Ángel González Sanz, UNCTAD.

⁵ Mr. Kekgonne Edinton Baipoledi, Botswana.

⁶ Mr. Madhi Elyasi, Deputy Vice-President for Science and Technology, Islamic Republic of Iran.

⁷ Ms. Funmi Adewara, Mobihealth International.

issues addressed by the company were the acute shortage of medical doctors, the widespread presence of counterfeit medicine, the language barrier, the lack of health insurance and high treatment costs in the country. Mobihealth provided an integrated telemedicine application, which allowed for video consultation, medical diagnostics and connection to multilingual medical doctors through mobile phones. Those virtual services were complemented by telehealth walk-in clinics for remote rural areas. Furthermore, Mobihealth also employed cloud-based technologies to listen to heart sounds. The remaining challenges were the lack of awareness and slow adoption rates, poor infrastructure and digital literacy, the lack of policies and the lack of funding and scalability. To address those challenges, the speaker suggested increasing efforts in digital education, local content adaptation and funding for health care and infrastructure.

9. One speaker⁸ discussed new technologies, the dynamics of job creation and societal learning. The impact of new technologies on jobs and employment was a dynamic process which created long-term trends in labour markets. First, the process innovation and productivity gains made with new business models destroyed jobs. Second, product innovation and market expansion generated new and different jobs. Third, job, skills and wage polarization affected the complexity of tasks, wages and labour market institutions. The speaker then introduced the dynamics of sustained growth and inclusive development, which had, at its core, societal learning and the constant transformation of a society's knowledge base. Policies and institutions drove the circular and cumulative dynamics of structural transformation and societal learning, which allowed for sustained growth to create more decent jobs. Decent work was also the necessary enabler of societal learning as it allowed for all societal actors and institutions to produce the societal learning process crucial for attaining the dynamics of sustained growth and inclusive development.

10. The fourth speaker⁹ provided an overview of a shared platform to accelerate digital inclusion, which focused on aspects of Internet access and adoption at the global and the country levels, Internet for all and public-private partnerships. The speaker identified the connectivity challenge as a coverage and usage gap. The four principal barriers that hindered universal Internet access and adoption were infrastructure, affordability, content, and skills, awareness and acceptance. An Internet-for-all framework increased multi-stakeholder coordination and collaboration to accelerate the deployment of new, scalable, and replicable models of increasing Internet access and adoption to connect the nearly 3.9 billion people currently offline. The speaker concluded by sharing discussion prompts on the need for public-private partnerships and dialogues, on coordination between sectors and on designing and exploring new models.

11. During the interactive discussion, delegates stressed that the effects of rapid technological change on labour markets needed to be elaborated on by drawing on concepts of societal learning and dynamic sustained growth. Participants inquired about the impact of rapid technological change on social inequalities, decent work and social challenges specific to developing countries. Participants discussed the role of the international community in overcoming barriers to connectivity in developing countries and noted the need for a new type of technological cooperation between developed and developing countries. In that regard, one delegate referred to the practice of technology transfer in the past and inquired about what the current approach to implementation of technological cooperation should be. Also, participants shared country experiences with rapid technological change, including the work of international organizations in technical assistance, and one delegate called for the sharing of best practices, especially among developing countries. Finally, several delegates expressed interest in the business model of Mobihealth International and inquired about potential expansions into their regions and how the business was able to overcome implementation bottlenecks and language barriers.

⁸ Ms. Irmgard Nübler, International Labour Organization.

⁹ Ms. Eniola Mafe, World Economic Forum.

A. Group discussion

12. The panel was divided into two groups with the purpose of holding interactive discussions on each of the priority themes. The interactive discussion on theme 1 was moderated by a Vice-Chair of the CSTD¹⁰ and was organized around three sub-themes: creating an ecosystem for inclusive and sustainable innovation on frontier technologies; providing directionality to technological change and mitigating risks; and the role of international and interregional collaborations. The moderator reported the group's findings to the plenary. The main points raised by the participants' discussion are highlighted in the paragraphs below.

13. For the first sub-theme, the group discussed the need to include in the analysis insights on the effect of rapid technological change on labour markets. In that regard, it was important to include policy recommendations related to social aspects, explanations on the current stage of labour automation and clarifications on the types of inequalities expected to increase specifically in developing countries. Furthermore, the group noted that the concept of open innovation in the context of intellectual property needed to be addressed as it could hinder and spur innovation. Some participants noted the need to address the intellectual property changes needed to move towards free data access and raised the necessity of developing a mechanism to share technologies among developing countries. Lastly, the group identified the need for connecting innovation with entrepreneurship. In that context, the group stressed the role of venture capital as a vehicle to transform innovative ideas into local projects and the role of specific frontier technologies, such as artificial intelligence and blockchain, which needed to be connected to existing industries, such as agriculture, and local start-ups in developing countries.

14. On the second sub-theme, the group addressed the need for specific policy instruments and proposed a set of concrete measures to implement the policy recommendations outlined in the issues paper. The measures included tax policy, such as tax incentives and exemptions, financial mechanisms, such as project-financing, innovation infrastructure, such as special economic zones, and government regulation. Another idea referred to combining the Technology Facilitation Mechanism with official development assistance. Furthermore, the group expressed the need for public sector innovation. Delegates mentioned that national legal frameworks needed to adapt more quickly to rapid technological change and stressed the importance of innovation in the public sector

15. On the third sub-theme, the group discussed the need for developing frameworks to assess performance in the area of inclusiveness in national science, technology and innovation policies. Participants discussed whether detailed benchmarks for science, technology and innovation policies providing directionality would be helpful. They mentioned that additional efforts towards a pragmatic approach to innovation and changing people's mindsets had to be made, which would establish innovation as a central pillar among the national priorities of developing countries. Lastly, participants shared country experiences and best practices in that context. Examples included a data-driven national initiative of Latvia, which started to include skills development programmes, and a partnership between Thailand and the United Nations Educational, Scientific and Cultural Organization to develop recommendations on the ethical dimensions of rapid technological change. Finally, the group concluded the discussion identifying the assessment of technology foresight and the development of normative frameworks as relevant topics for future discussions in the context of the CSTD.

¹⁰ Mr. Peter Major, Hungary.

V. Theme 2: Exploring space technologies for sustainable development and the benefits of international research collaboration in this context

16. The Director of the UNCTAD Division on Technology and Logistics and Head of the CSTD secretariat¹¹ introduced the second issues paper, which highlighted the ways space technologies, science and data have the potential to contribute directly and indirectly to the Sustainable Development Goals. Space technologies could help monitor progress towards the Goals and support policy decisions by providing real-time information and time-series data from central or remote locations. They could be used to estimate national and global crop production, monitor infectious disease patterns and detect deforestation and illegal logging. In addition, they could provide real-time information in disasters and humanitarian crises, estimate national and urban poverty and help bridge the digital divide through telecommunication satellite services. Recent technological developments, such as machine learning, big data and cloud computing, made it possible to gain automated insights from satellite imagery, for example, for poverty monitoring and agricultural applications. Despite the decreased costs of some space technologies and the increasing availability of open-source data, bottlenecks continued to hinder space applications. Bottlenecks included the lack of awareness among policymakers about the benefits of space technologies, the high costs associated with the development of space programmes and the skill gaps to develop, use and adapt space technologies. Furthermore, many developing countries still did not have access to such innovative technologies, human capacity or the infrastructure to effectively utilize and apply those tools. Multi-stakeholder partnerships and international cooperation offered an opportunity to bring together countries with advanced experience in using innovative space applications, as well as countries that could use the information and tools but lacked the knowledge or capacity to do so. To successfully promote harnessing space technologies for the Sustainable Development Goals, effective policies and strategies at the national, regional and international levels must be implemented.

17. The panel was moderated by a Vice-Chair of CSTD.¹² One speaker highlighted that space technology should not be seen as something “out there”, but rather something that was directly applicable to a wide range of issues on Earth.¹³ He introduced to the panel, Copernicus, the European Union’s Earth Observation Programme, which produced large amounts of global data from satellites as well as ground-based, seaborne and airborne measurement systems. The data was processed into value added information, which could help stakeholders develop strategies to assess, track and attain the Sustainable Development Goals. He noted that free and open data had limited applicability if users lacked the necessary capabilities to use the data effectively. Therefore, he recommended that capacity-building measures should be implemented in parallel with the availability of the data. He concluded by highlighting the importance of changing stakeholder perceptions of new technologies from disruptive factors into tools to achieve and monitor the Sustainable Development Goals.

18. Another speaker discussed the significance of using satellite and in situ data to monitor the global crop situation. He used three case studies to exemplify how Crop Watch provided information to developing countries and cloud facilities to enhance their monitoring capacities.¹⁴ He added that a customized Crop Watch Cloud for Mozambique had been incorporated into the National Agro-Meteorological Bulletin. In Thailand, Crop Watch provided an application programming interface to feed agro-climate and agronomic information to the farming application Agri-Ma. In 2018, Drought Watch Mongolia was handed over to the Mongolian National Remote Sensing Centre, to assist in planning and decision-making for crop farming, as well as in the forest and pastoral animal husbandry sector. The speaker stressed both the significance of cloud-based systems in removing the

¹¹ Ms Shamika Sirimanne, UNCTAD.

¹² Mr. A Min Tjoa, Representative of Austria.

¹³ Mr. Mauro Facchini, Head of Unit EU, European Commission, European Union.

¹⁴ Mr. Wu Bingfang, Professor, Institute of Remote Sensing and Digital Earth, CAS, Beijing.

need for capital-intensive investment in infrastructure and the importance of promoting ownership over the process for developing countries. Systems should be customized according to the specific demand of each country. Combined with training, this would strengthen individual agricultural monitoring capacity and promote leap-frog development.

19. One speaker¹⁵ emphasized that, if localized projects using space technologies were fostered in partnerships with start-ups, academia and Governments, the results they yielded could be highly innovative and relevant. The speaker focused on how six types of space technologies currently supported the Sustainable Development Goals. She used several case studies to illustrate how the space-enabled research group at the MIT Media Lab applied the six space technologies, in collaboration with relevant stakeholders. In *Lake Nokoué in Benin*, they collaborated with the start-up Green Keeper Africa to monitor an invasive plant used to clean oil-based waste using space technology, such as satellite Earth observation, aerial Earth observation and sensors placed in the local water. Similarly, another project explored the use of wax as fuel for small satellites.

20. Another speaker¹⁶ focused on the role of space-based technologies as vehicles for national economic development. He noted that most African countries had not had the opportunities to participate in this field. Furthermore, many had hardly accepted space technology as a tool for economic development. He emphasized that outer space was humanity's common heritage and that developing countries must be allowed equal access to it. The speaker shared the experiences of the Nigerian Space Programme concerning various impacts and applications of space assets. The speaker highlighted the need for greater African ownership of communication satellites, the positive impact that space technology could have on the gross domestic product of a nation, the idea that space technology should be viewed as an economic development tool and that the Nigerian experience suggested that private-public partnerships were fundamental to sustain space technology development.

21. In the ensuing interactive discussion, participants agreed that space-related technologies could effectively help achieve the Sustainable Development Goals. They also expressed concern over persisting bottlenecks hindering their effective application in certain fields and locations. Several participants focused on the issue of convincing policymakers to prioritize space programmes, funding challenges and capacity-building issues, particularly in developing countries. Panellists stressed the advantages of building limited but effective national capabilities and train experts within the field to communicate more effectively the direct and indirect benefits of space technologies. They also highlighted the advantage of international cooperation in leveraging comparative advantages and the usefulness of building capabilities through partnerships with academia and industry. One participant highlighted the issue of both the cost and availability of high-resolution data for developing countries and questioned whether the United Nations could assist in its procurement. Participants and panellists encouraged greater solidarity and data democracy in the field of space technology and commented on the usefulness of using massive online open courses to support training for space applications.

A. Group discussion

22. The panel was divided into two groups to hold interactive discussions on each of the priority themes. The interactive discussion on theme 2 was moderated by a Vice-Chair of the CSTD,¹⁷ who reported the group's findings to the plenary. The main points raised by participants in the discussion are highlighted in the paragraphs below.

23. The group discussed potential opportunities of space-enabled technologies for delivering on the Sustainable Development Goals, policy options for harnessing space technologies for sustainable development, the role of international research collaboration to support those efforts and related bottlenecks for future development. The group shared their

¹⁵ Ms. Danielle Wood, Assistant Professor, Massachusetts Institute of Technology.

¹⁶ Mr. Halidu Ibrahim, Director, National Space Research and Development Agency, Abuja.

¹⁷ Mr. A Min Tjoa, Representative of Austria.

project and policy experiences from the field of space technology. The group's recommendations for future action included the potential for cooperative bilateral agreements, where countries leveraged their comparative advantage in downstream or upstream capabilities. It also recommended that countries pursue collaborations with the private sector and academia and international sharing of best practices, experiences from development of space programmes and policies, as well as open data, cloud and science policies. One participant noted that countries that did not have space agencies and policies faced special challenges and asked that the Commission give special importance to their specific needs.

24. Furthermore, participants highlighted various strategies and networks that could enhance national and international collaboration and grow human resources. One participant noted the importance of reflecting in the paper that the African region should aim to have launching capabilities. The group also identified challenges associated with trying to implement space-enabled projects. Challenges included issues associated with utilizing data for best practices decision-making, the need to train experts in utilizing information obtained from space technology effectively, lack of infrastructure and skill gaps. Participants noted several ways that space technology could impact other technological developments and vice versa. The group also commented on how artificial intelligence and machine learning were transforming data collected by space technology into policy-relevant information, as well as the significance of cloud services in addressing the most significant bottlenecks developing countries faced in using space technology.

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

25. This panel discussion was moderated by a Vice-Chair of CSTD.¹⁸ Participants discussed the implementation and follow-up of WSIS outcomes on several different fronts including new challenges, concrete actions taking place and relevant forums and conferences.

26. The first speaker¹⁹ highlighted the current state of play in implementing WSIS outcomes. Unlike the time when WSIS took place, the focus was shifting from the Internet in general to digital technologies more specifically. The world had learned since WSIS that digital divides reflected the existing inequalities and recent developments of digital technologies, such as fifth-generation technology, could further accelerate digital divides. An important lesson so far was that ICT developments did not guarantee development gain and there needed to be development framework and policies in place to achieve the people-centred, inclusive and development-oriented information society. To ensure that developments in ICT worked for society and to monitor progress, more data and evidence, especially disaggregated data vis-à-vis gender, urban/rural and age groups, among others, should be made available. Multi-stakeholder participation was another key to increase the quality of discussion and inputs. Therefore, the open doors should be opened for all parties, such as academia, technology users, technology providers and others.

27. The second speaker²⁰ provided updates and developments on the WSIS outcome from the WSIS Forum 2019 and the United Nations Group on the Information Society, as well as the preparation process for the WSIS Forum 2020. The WSIS Forum 2020 would take place from 6 to 9 April in Geneva. It would be composed of a high-level track, special tracks, including topics such as youth, gender, sports, older persons, extended reality, space and accessibility, as well as other events such as a hackathon, talk and exhibition. Other side initiatives of the WSIS Forum 2020 would involve the WSIS stocktaking platform and WSIS prize in which 100 projects were participating. Aside from the WSIS Forum, the International Telecommunication Union was also engaging in important activities in the

¹⁸ Mr. Peter Major, Hungary.

¹⁹ Mr. David Souter, ICT Development Associates.

²⁰ Mr. Catalin Marinescu, International Telecommunication Union.

fields of space and rapid technological change, aligning with the year's themes of the CSTD.

28. The third speaker of the session²¹ showcased the community-based connectivity initiatives in Africa as a follow up of WSIS outcomes happening on the ground. The initiatives started from the concern with limited connectivity to second-generation, third-generation and fourth-generation networks. The connectivity issues involved not only access but also quality access such as gender gap in access due to skills and literacy and urban and rural connectivity divide as neither easy nor profitable for the providers to ensure access, leading to digital inequalities.³⁷ Community network initiatives, of which 30 are currently active, including Zenzeleni Mankosi in South Africa, Pamoja NET in the Democratic Republic of Congo and BOSCO in Uganda, were all following the bottom-up models initiated by the local communities to address connectivity gaps and provide Internet access for free or at the very low price. The impact of these human-centred initiatives included local control over how the network was used, attention to the needs of marginalized people, lower costs and retention of more funds within the community and had fostered a sense of agency and empowerment.

29. The fourth speaker²² presented information regarding the Internet Governance Forum (IGF) 2019 and updates of the progress so far. This year's IGF will be held on 25–29 November 2019 in Berlin, hosted by the Government of Germany. There are more than 200 sessions scheduled with a focus on data governance, digital inclusion and security, safety, stability and resilience. As stated by the Secretary-General of the United Nations in 2019 at the Forum, IGF aimed at being a platform of more than multi-stakeholders, but multi-disciplinary and picking up missing voices, such as private sector participants in the year.

30. During the ensuing interactive discussion, some participants stressed the necessity for regulatory supports to ensure the connectivity for marginalized communities. One participant stated that the discussion for spectrum for marginalized communities was on the agenda for the WSIS Forum 2019 and suggested the possibility of including it in the agenda for the WSIS Forum 2020 if required. In that context, some participants noted the low possibility of attaining universal connectivity by 2020 based on International Telecommunication Union data. Other participants stressed the potential of fifth-generation technology as a critical technology given its importance for the Internet of things. Some participants noted the follow-up work to the High-Level Panel on Digital Cooperation and the upcoming related activities during the IGF Forum in Berlin. One speaker noted that the IGF 2019 would provide opportunities to provide feedback on the report of the High-Level Panel²³ given that the Secretary-General of the United Nations planned to implement the parts of the report which attracted more attention and support first. In that regard, there was no definitive champion for the follow-up of the report and the opportunity was still open for those who were interested in taking it up. To conclude, one participant requested the CSTD secretariat to distribute the draft resolutions in advance to provide enough time for Member States to prepare towards the annual session of the Commission, which would be held from 23 to 27 March 2020.

VII. Findings and suggestions

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

²¹ Ms. Josephine Miliza, Kictanet Africa.

²² Mr. Chengetai Masango, IGF Secretariat.

²³ See <https://www.un.org/en/pdfs/DigitalCooperation-report-for%20web.pdf>.

A. Harnessing rapid technological change for inclusive and sustainable development

1. Main findings

32. Harnessing rapid technological change is critical for achieving inclusive and sustainable development. It also has the potential to exacerbate existing inequalities within and among countries. Governments, private sectors and the international community should address key challenges head-on. International collaboration and national science, technology and innovation policies are needed to provide the enabling environment to steer rapid technological change towards improved inclusiveness and reduced inequalities, while innovative and sustainable business models are crucial for channelling innovations using frontier technologies towards inequality-related challenges. Participants raised general points for consideration. These include, first, the effects of rapid technological change on labour markets need to be elaborated on by drawing on concepts of societal learning as well as dynamically sustained growth. Second, the concept of open innovation in the context of intellectual property needs to be addressed given that intellectual property can both spur and hinder innovation. Third, connecting innovation with entrepreneurship is highly relevant given that using venture capital as a vehicle to transform innovative ideas into real projects can contribute to the implementation of innovations.

2. Suggestions

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

(a) Design and implement science, technology and innovation policies that provide directionality to rapid technological change towards inclusive outcomes, including by creating an enabling ecosystem for innovative approaches for reducing inequalities and through periodic reviews of national and regional priorities;

(b) Promote national digital agendas that support closing digital divides in access and skills through appropriate ICT infrastructure and improving users' capabilities, especially among vulnerable groups, youths and women and girls;

(c) Promote policies for skills development relevant to rapid technological change in terms of life-long learning, entrepreneurship training, upgrading of skills for innovators and capacity-building for researchers;

(d) Encourage decent work, through promoting decent jobs, facilitating labour mobility and supporting fair relationships between workers and employers;

(e) Foster innovation through entrepreneurship by strengthening funding mechanisms for innovation;

(f) Prepare for future changes through developing scenarios from rapid technological change for the workforce and the business sector;

(g) Promote the need for public sector innovation for rendering legal frameworks more responsive towards rapid technological change;

(h) Apply a pragmatic, cross-cutting approach which allows Governments with pressing priorities to prioritize innovations as a way of solving current societal challenges.

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

(a) Strengthen research cooperation and science–policy interfaces to ensure that frontier technologies are harnessed for inclusiveness and sustainability;

(b) Address the need for consistent normative frameworks and ethical principles relevant for rapid technological change for inclusive and sustainable development;

(c) Promote and develop international technology assessment and foresight mechanisms to help countries assess the challenges and opportunities of rapid technological change for inclusive growth;

(d) Share experiences on successful and innovative business models that harness rapid technological change to support inclusiveness and sustainability to facilitate collaboration and dissemination.

35. The intersessional panel encourages the Commission to take the following courses of action:

- (a) Share experiences on specific models for guiding Governments in designing science, technology and innovation policies for harnessing rapid technological change with detailed benchmarks;
- (b) Encourage connecting discussions of science, technology and innovation policies with discussions on the future of work;
- (c) Compile and share examples of innovative business models to support successful technological change;
- (d) Develop synergies among the efforts of United Nations entities on science, technology and innovation for inclusive and sustainable development.

B. Exploring space technologies for sustainable development and the benefits of international research collaboration in this context

1. Main findings

36. Space science, technology and data holds the potential to help achieve the 2030 Agenda for Sustainable Development and the Sustainable Development Goals. Costs are being driven down by new technological developments and collaborations between local, national, regional and international stakeholders. Yet, development in this area is challenged by persistent bottlenecks, including lack of awareness of the benefits of space technologies, limited financial resources and technology and skill gaps to develop, use and adapt space technologies. National and regional policies and strategies to support space for the Sustainable Development Goals should include efforts to build upstream and/or downstream capabilities, improve infrastructure and increase public awareness, develop policies for open data and open science for geospatial data and leverage public-private cooperation around common goals for space for the Sustainable Development Goals. The international community is encouraged to develop collaborative agreements that take advantage of countries' competitive advantages, encourage regions to develop their own space facilities and develop space capacity by training space technology experts to incorporate them in the policy process.

2. Suggestions

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

- (a) Develop national policies and strategies with a grand challenges approach to space for Sustainable Development Goals that brings together Governments, academia, the private sector and civil society to take part in these activities, from basic research to implementation;
- (b) Work with private sector to deliver products to end users;
- (c) Increase national support for the building of upstream capabilities (such as launch facilities and satellite engineering) and downstream capabilities (such as processing, analysing Earth observation data etc.);
- (d) Develop open data, cloud and science policies that incorporate sharing of Earth observation data;
- (e) Encourage education collaboration through networks of universities to build space capabilities such as the University Space Education Consortium and United Nations Space Generation Advisory Council;

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

- (a) Develop cooperative bilateral agreements that leverage competitive advantages;
- (b) Encourage regions to explore the development of their own space facilities;

(c) Develop space capacity through “train the trainers” and/or massive open online courses;

(d) Continue to build and support intergovernmental platforms that strengthen capacities of end users of geospatial data in developing countries.

39. The intersessional panel encourages the Commission 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) Share best practices and lessons learned on formulation of space policy policies, development of space programs and utilization of space for Sustainable Development Goals applications.

Annex I

Group discussion on harnessing rapid technological change for inclusive and sustainable development

Sub-theme 1: Creating the ecosystem for inclusive and sustainable innovation on frontier technologies

- How could Governments better support the creation of ecosystems for innovation in frontier technologies for inclusive and sustainable development?
- What are the most effective ways to support the improvement of skill levels for harnessing rapid technological change?
- How can science, technology and innovation policies ensure that no one is left behind in a world of rapid technological change?

Sub-theme 2: Providing directionality to technological change and mitigating risks

- Can you provide examples of science, technology and innovation policies/projects/initiatives intended to promote and give directionality to technological change to make it work for inclusive and sustainable development?
- Are there policies/projects/initiatives that mitigate the potential negative effects of rapid technological change on inequality?
- Are any of these policies/projects/initiatives directed to women, youth, people with special needs or other groups facing specific challenges? How have the policies targeted inequalities?
- What are the challenges in implementing these policies/projects/initiatives?

Sub-theme 3: The role of international and inter-regional collaborations

- What are the actions that the international community, including the Commission on Science and Technology for Development, can take to contribute to maximizing the benefits associated to rapid technological change and to mitigate the risk of these technologies widening or creating new inequalities within and across countries?
- Can you give any success stories in this regard from your country or region?

Annex II

Group discussion on exploring space technologies for sustainable development and the benefits of international research collaboration in this context

Key questions for discussion:

- What are examples of projects and/or policies in your country aimed at using space technologies for sustainable development?
- What are the main challenges confronted while trying to implement space-enabled projects and/or policies in your country or region?
- How are recent technological developments – including machine learning, big data, cloud computing, CubeSats, nanosats, 3D printing – impacting the availability, accessibility and/or cost of applying space technologies for the Sustainable Development Goals?
- How is increased private sector involvement in space science and technology impacting the value proposition for space exploration, Earth observation, and other space applications, particularly for developing countries?
- What are the most significant bottlenecks in the use of space technologies for developing countries? Key areas to consider include lack of awareness about potential developmental benefits, technology and skills gaps, lack of appropriate and targeted financing, national policy and governance challenges, and lack of intergovernmental and/or domestic cooperation.
- What are examples of policies, projects and initiatives aimed at promoting international research collaboration in the area of space technologies for sustainable development? What are the main challenges confronted in implementing these projects?
- What are effective forms of bilateral and regional collaboration (e.g. data sharing arrangements, joint research, capacity-building, joint launch of satellites) that enable space applications for the Sustainable Development Goals and/or address application bottlenecks?
- What are the actions that the international community, including the CSTD, can take to leverage the potential of space technologies for sustainable development, including through international research collaboration in this context? Can you give any success stories in this regard from your country or region?
