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Item 2 of the provisional agenda

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

Item 3 of the provisional agenda

Science and technology for development

Report of the intersessional panel meeting

Held at the Palais des Nations, Geneva, from 17 to 19 November 2021

Prepared by the UNCTAD secretariat¹

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-fourth session in May 2021, the Commission on Science and Technology for Development (CSTD) selected the following substantive themes for its 2021–2022 intersessional period:

- (a) Industry 4.0 for inclusive development;
- (b) Science, technology and innovation for sustainable urban development in a post-pandemic world.

2. To help address these themes, a panel meeting was organized by the CSTD secretariat from 17 to 19 November 2021 and was held with physical and remote participation. Participants at the meeting also discussed the 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. The aim of the meeting was to examine in depth various issues related to the substantive themes, with a view to contributing to considerations by CSTD at its twenty-fifth session, to be held from 28 March to 1 April 2022.

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 on the two themes prepared by the CSTD secretariat with inputs from members of CSTD and relevant international organizations; and presentations and written comments submitted by participants. Meeting documents are available on the CSTD website.²

III. Opening

4. The panel meeting was opened by the Chair of CSTD.³

5. The Director of the Division on Technology and Logistics of UNCTAD and Head of the CSTD Secretariat expressed her appreciation for the contributions to the papers prepared by the secretariat and elaborated on the recent efforts of UNCTAD to support developing countries in harnessing science, technology and innovation for development. These efforts included the following: UNCTAD *Technology and Innovation Report 2021*, which addressed the relationship between frontier technologies and inequality; a project on technology assessment in Africa; progress in the science, technology and innovation policy reviews for Botswana, Uganda and Zambia; a workstream on capacity-building under the Technology Facilitation Mechanism of the United Nations; the Crop Watch Innovative Cooperation Programme, in collaboration with China, to facilitate agricultural monitoring through the use of satellite data in developing countries; the Young Female Scientist Programme organized with Okayama University, Japan; and CSTD collaboration with China on capacity-building. She also underscored the challenges posed by the coronavirus disease (COVID-19) pandemic and the successful global scientific collaboration in providing solutions to develop effective vaccines. Finally, the Director highlighted the urgent need for greater international cooperation and solidarity and the faster deployment of both old and new science, technology and innovation solutions to help address multiple national and global challenges and improve people's lives.

6. The Deputy Secretary-General of UNCTAD, in her keynote address, highlighted the capacity of science, technology and innovation to improve lives and build resilience, as seen during the COVID-19 pandemic. She noted that the two substantive themes of CSTD served to illustrate the need to pursue technological change that was at the service of development. With regard to the first theme, new technologies were expected to improve productivity and sustainability when applied in manufacturing. However, a large share of firms in developing

² See <https://unctad.org/meeting/cstd-2021-2022-inter-sessional-panel>.

³ Mr. Peter Major, Hungary.

countries was not ready to deploy such technologies. Therefore, countries needed to adopt a balanced approach that stimulated and developed diversified and robust manufacturing while promoting the adoption of industry 4.0 technologies. Countries also needed to seek partnerships and international collaborative arrangements to help achieve industry 4.0 objectives. With regard to the second theme, the Deputy Secretary-General noted that the pandemic had aggravated existing sustainability challenges and served to uncover several vulnerabilities and inefficiencies in cities worldwide. Science, technology and innovation could contribute to addressing such problems, for example, by enabling the circular economy and promoting gender equality. Finally, the Deputy Secretary-General emphasized the importance of international collaboration in order to realize the potential of science, technology and innovation in the pursuit of the Sustainable Development Goals.

IV. Theme 1: Industry 4.0 for inclusive development

7. The CSTD secretariat⁴ introduced a paper on this theme, which analysed the possible impact of industry 4.0 on inequalities between countries, highlighting that the use of industry 4.0 technologies in manufacturing could increase productivity and energy efficiency and promote sustainability. However, most firms in developing countries were not yet using such technologies and there was a risk that the uneven deployment of industry 4.0 technologies could perpetuate the income gaps across countries seen during previous technological revolutions. Therefore, developing countries could not afford to miss this new wave of technological change. Much would depend on national policies to build a diversified industrial base while disseminating industry 4.0 technologies in manufacturing. Partnerships and international collaboration would also be required, to facilitate this process.

8. The first panel discussion was moderated by a Vice-Chair of CSTD.⁵ One speaker⁶ drew attention to three megatrends, namely, digital technology evolving at a significant pace; climate change; and socioeconomic instability. She shared evidence from a company-level study and noted the following three lessons learned during the pandemic: the supply network had not been ready for the challenge; companies adopting industry 4.0 technologies were better able to navigate the pandemic; and collaboration across industries and between the private and public sectors had gained in importance. In this regard, Governments and businesses needed to focus on reconfiguring supply chains, setting up remote work and operations abroad that supported different promotion networks globally, finding ways for companies to respond quickly to shifting demands, prioritizing end-to-end visibility and embracing true collaboration. Finally, the speaker stressed that essential elements of a robust and inclusive transformation were understanding global trends and how these affected local ecosystems, fostering multi-stakeholder collaboration, prioritizing the most relevant areas for each particular economy and context and learning from success stories.

9. Another speaker⁷ noted that a challenge faced by countries in deploying industry 4.0 technologies was the need for a skilled labour force, as the demand for industry 4.0 solutions would outgrow the capacity of countries to train workers. At the same time, technology was developing at a swift pace and it was hard for firms to keep abreast of developments. The lack of standards with regard to industry 4.0 also posed a challenge in the deployment of such technologies. The speaker emphasized the need for factory workers and information and communications technology experts to foster the transformation in manufacturing. The benefits of industry 4.0 were significant in terms of productivity and promoting sustainability. Finally, the speaker stated that the ability to adopt and use industry 4.0 technologies was country-specific yet the price points at which such technologies could be deployed were significantly low, allowing developing countries with a solid manufacturing base to deploy and further develop them.

⁴ Mr. Clovis Freire Junior, UNCTAD.

⁵ Ms. Ana Cristina Amoroso das Neves, Portugal.

⁶ Ms. Maria Basso, Lead, Advanced Manufacturing and Production, World Economic Forum.

⁷ Mr. TP Chopra, Chief Executive Officer, Bharat Light and Power Group.

10. One speaker⁸ highlighted the important topics detailed in the paper prepared by the secretariat, including the importance of industrialization and industrial policy for inclusive development. Governments needed to have an active role in supporting this process and the international community needed to invest in Government capacities. Firms with advanced digital capacities had been better able to weather the COVID-19 crisis, which served to highlight the critical role of such technological capacity in increasing resilience. Governments needed to build skills and capacity to foster technological learning and innovation and sustain growth. In the context of industry 4.0, this would require a shared vision, common knowledge and understanding and coordinated action with Governments and other stakeholders, to drive technological upgrades in manufacturing. Finally, the speaker stressed the need to strengthen international collaboration, stating that common challenges required agreed and coordinated solutions in peer learning, sharing knowledge, improving global coordination and enabling a global institutional environment.

11. During the ensuing interactive discussion, participants expressed their support for CSTD, which continued to provide a platform for countries to discuss common challenges and share experiences and good practices. A few delegates⁹ shared the initiatives and policy instruments that the Philippines and Thailand had put in place to build technological and innovation capacities in firms, including small and medium-sized enterprises, and to promote technological upgrading and the deployment of industry 4.0 technologies. The Philippines had implemented a series of programmes that allowed for the simplified storage and sharing of environmental and geospatial data for public use, to address the lack of sufficient telecommunications bandwidth, interconnectivity and public information and communications technology infrastructure. In addition, the Philippines had established 38 regional research and development centres and provided funding mechanisms for joint research projects between universities and private industry. Finally, the Philippines had invested heavily in upskilling the workforce in data sciences, data analytics and smart governance practices. Thailand had launched an industry 4.0 index that aimed to improve the competitiveness of industries, provide incentives for small and medium-sized enterprises to transition and prepare the workforce to meet the future demands of industry 4.0. Thailand had also established several programmes and platforms that focused on lifelong learning, future skill sets and high-quality human resources development, particularly in the field of research and innovation.

12. The representative of a non-governmental organization¹⁰ stressed the challenge of the lack of gender balance in technology development and emphasized the need for action to develop digital skills, particularly in the least developed countries, create job opportunities for youth and offer technological solutions to address sexual harassment at schools and workplaces. In response to queries from some delegates¹¹ and representatives of non-governmental organizations¹² as to how the technological divide between countries might be bridged and the role of international cooperation in supporting this process, the speakers noted that this was a challenge for everyone and that no single country or company had the perfect recipe for industry 4.0 transformation. Part of the internal work that needed to be conducted to understand the particular needs in an area involved creating a task force that included the public and private sectors; and the external work required included creating partnerships and connecting to available solutions and tools globally. A challenge in this regard was that Governments did not always have all the information or knowledge required to make decisions related to industry 4.0. Therefore, Governments needed to develop tools and initiatives to engage with firms and better understand their needs. A delegate¹³ highlighted the importance of including concrete recommendations and actions in the paper prepared by the secretariat and the need to put in place cooperation projects that simultaneously involved academia and industry from both developed and developing

⁸ Mr. Fernando Santiago Rodriguez, Industrial Policy Officer, United Nations Industrial Development Organization.

⁹ Representative of the Philippines; Representative of Thailand.

¹⁰ World Federation of Engineering Organizations.

¹¹ Representative of the Gambia; Representative of the State of Palestine.

¹² Pompiers Humanitaires Solidaires, Guinea; African Council on Narcotics, Nigeria.

¹³ Representative of Cuba.

countries, as this would permit the fostering of international cooperation in technology transfer and capacity-building, which was a prerequisite for the implementation of the 2030 Agenda for Sustainable Development and the promotion of industry 4.0.

V. Theme 2: Science, technology and innovation for sustainable urban development in a post-pandemic world

13. The CSTD secretariat¹⁴ introduced a paper on this theme, which focused on the contribution of science, technology and innovation practices towards mitigating some of the most pressing sustainability challenges facing urban sociotechnical systems in a post-pandemic world; and assessed the impact of the pandemic on sustainable urban development, identifying 12 key urban sustainability challenges in relation to energy, circularity, water, mobility, economic prosperity and financial stability, housing, gender-related empowerment and equality, urban planning, safety and security, protection from natural disasters, education and health care. Under each category, a selection of practical science, technology and innovation solutions and innovative case studies worldwide were presented. Finally, the need for action at the national and international levels to seize the innovation momentum from the pandemic and to use the transformative power of science, technology and innovation to deliver on the commitment to sustainable urban development were emphasized. Governments needed to prioritize the science, technology and innovation solutions that ensured value for money and more efficient spending, focusing on activities that boosted urban resilience. International cooperation efforts were needed to further pool, formalize and transfer available knowledge of effective science, technology and innovation solutions.

14. The second panel discussion was moderated by a Vice-Chair of CSTD.¹⁵ One speaker¹⁶ provided strategic advice on how to unleash the urban sustainability potential embedded in the science, technology and innovation solutions noted in the paper prepared by the secretariat. The speaker suggested that technological solutions could be combined with innovations in institutional settings, funding mechanisms, governance and organizational systems, user behaviour and business models. This could contribute to preparing an effective transformation path and a deep and localized understanding of the problems at hand. However, However, people in many urban settings had a technocentric understanding of science, technology and innovation solutions, which might combine with a one-size-fits-all mentality. Instead, to enhance urban sustainability, science, technology and innovation solutions would benefit from a people-centred focus and should be conceived and deployed with a consideration of local context conditions. Finally, the speaker noted that many urban sustainability challenges, such as poverty, were due to a mix of socioeconomic and environmental forces and it was therefore essential to emphasize the importance of capacity-building, cooperation, integration, systemic thinking and programmatic approaches.

15. Another speaker¹⁷ discussed challenges in urban areas in developing countries and the digital and urban interface, focusing on research on young women in low-income neighbourhoods in urban peripheries and describing the concept of authorship in digital and physical spaces and the idea of a feminist toolkit. The speaker emphasized that women's access to technology should not be seen merely as a sign of empowerment but also as an opportunity to use such tools to articulate struggles in supportive and safe spaces. Research showed the failure of technology to address young women's struggles related to online spaces and that experience-sharing could lead to empowerment. Finally, the speaker stressed the need for technology to enable people to speak openly.

16. One speaker¹⁸ drew attention to economic challenges during the pandemic and shared the results of a report on smart urban technologies applied in addressing the pandemic in China. Outbreaks of disease in the past had led to re-examinations of urban resilience and the creation of new legislation and, in this regard, the speaker stressed the importance of working

¹⁴ Ms. Liping Zhang, UNCTAD.

¹⁵ Mr. Muhammadou MO Kah, Gambia.

¹⁶ Mr. Luca Mora, Professor, Urban Innovation, Tallinn University of Technology.

¹⁷ Ms. Ayona Datta, Professor, University College London.

¹⁸ Mr. Sheng Ying, National Officer, China Office, United Nations Human Settlements Programme.

towards a new level of urban resilience, which was essential in reducing economic loss and reconstruction costs following unexpected events, with technology crucial in supporting such actions. New urban resilience was important in achieving many of the Sustainable Development Goals, from reducing poverty to improving gender equality. Finally, the speaker detailed the action stages of a project to help improve urban public health and the urban technologies that could be used at each stage; and presented examples of the use of artificial intelligence and big data to visualize the pandemic and of a newly created online medical service platform that aimed to facilitate daily life.

17. Another speaker¹⁹ underlined how the increased challenges during the pandemic might prevent public institutions from being cooperative and risk-taking; and highlighted the importance of the analysis in the paper prepared by the secretariat, as it had examined ways to address such challenges. The speaker noted the following three key areas that required a greater focus: the use and governance of land needed to receive greater attention; given the interdependence of challenges and science, technology and innovation solutions, there was a need to connect them to gain a complete understanding of the interactions and linkages, since viewing science, technology and innovation solutions and challenges independently from each other could result in disconnected and fragmented initiatives, dealing with symptoms instead of examining root causes; and underestimations in the reporting of global imbalances in science, technology and innovation capacities needed to be addressed. Finally, sharing an example of solutions to housing issues in upper middle-income countries that did not meet the needs of developing countries, the speaker stated that technologies needed to be adapted to different geographical contexts.

18. During the ensuing interactive discussion, one delegate²⁰ highlighted that the paper prepared by the secretariat and the present discussion came at a crucial time, given the unprecedented pressures on urban areas due to the pandemic, and particular emphasis needed to be placed on the role that novel data-sharing solutions played in responding to the pandemic. Another delegate²¹ shared the experience of Thailand in adopting a bio-circular-green economy model, to advance more sustainable urban development, which integrated the bioeconomy, circular economy and green economy through the use of science, technology and innovation to capitalize on the rich biodiversity and cultural diversity of the country with a view to evenly distributing the benefits of prosperity to the wider community. Thailand had also developed transport infrastructure linking major cities to peripheral provinces to redistribute economic growth more fairly across urban-rural areas, promote urban-rural linkages, reduce inequalities, increase employment and address healthy urban-rural migration. One delegate²² highlighted the importance of data as a significant development enabler and underscored that building resilience was one of the most critical challenges for developing countries. Another delegate²³ noted that particular attention should be given to multilateralism and international cooperation. A representative of an intergovernmental organization²⁴ identified the need to measure progress in implementing digital technologies in response to the pandemic and, in this context, stated that particular reference should be made to the key performance indicators for smart sustainable cities developed by the United for Smart Sustainable Cities initiative to help achieve Goal 11. Finally, a representative of a non-governmental organization²⁵ underlined the importance of parental education for people living in urban areas in pandemic recovery efforts.

¹⁹ Mr. Ivan Turok, Professor, City-Region Economies, University of the Free State, South Africa.

²⁰ Representative of the United Kingdom of Great Britain and Northern Ireland.

²¹ Representative of Thailand.

²² Representative of the State of Palestine.

²³ Representative of the Islamic Republic of Iran.

²⁴ International Telecommunication Union.

²⁵ World Organization of Prenatal Education Associations.

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

19. The third panel discussion was moderated by the Acting Chair of CSTD.²⁶ Participants considered the implementation of and follow-up to the outcomes of the World Summit on the Information Society in 2021 in several respects, including ongoing and new challenges, achievements and activities at forums and conferences. Several speakers noted the critical role of information and communications technology in helping people and businesses handle the ongoing challenges related to the COVID-19 pandemic, the continued persistence (and even growth) of digital divides and the importance of continuing international cooperation to be able to address digital divides and the inequalities associated with the diffusion of digital technologies.

20. One speaker²⁷ stated that the world had changed significantly since the World Summit on the Information Society and that it was essential to take into account the changing context. However, addressing the challenge of overcoming digital divides remained critical. He stressed that while taking advantage of many of the new opportunities related to science, technology and innovation and information and communications technology could contribute to development, the process of digitalization had been accompanied by risks in areas such as the digital divide, along with broader social and economic inequalities, cybercrime, insecurity, challenges to human rights and disinformation. In addition, the context in which the information society was evolving would be affected by externalities in politics and economics, climate change, the threat of further pandemics and the risks associated with conflicts and geopolitical instability. The speaker outlined the following six main areas of focus related to the information society in recent reports issued by international organizations: the pandemic, which had served to highlight the importance of connectivity and electronic commerce and the value of data gathering and analysis; climate change, focusing on the need for sustainability strategies to reap the benefits of digitalization, with the energy consumption of information and communications technology and electronic waste presented as challenges to be overcome; innovation and equity, that is, the relationship between technology, data and development, including with regard to artificial intelligence, robotics and virtual reality; the digital economy, mainly with regard to mobile money, digital money, digital identity and cross-border payments, with implications for national sovereignty and data protection; governance of digitalization, highlighting the role of multi-stakeholder perspectives and international forums; and digital cooperation, including *Report of the Secretary-General: Road Map for Digital Cooperation*. The speaker noted that some World Summit on the Information Society aspirations had not yet been fulfilled, namely, digital equality levels did not match advances in technology and governance institutions had not adapted to take into account new power structures. Finally, the speaker stressed that the review in 2025 should not only look back and measure progress but also reflect on the current information society, considering the new international context.

21. Another speaker²⁸ provided an update of the outcomes of the World Summit on the Information Society Forum 2021 and the planning and preparation process for Forum 2022. Forum 2021 had been held with the theme of “ICTs for inclusive, resilient and sustainable societies and economies”. Over 50,000 participants from over 150 countries, 43 per cent of whom were women, had taken part in about 250 online sessions held over a four-month period, including a high-level track, workshops, interviews, talks, a hackathon and many other events. At the request of stakeholders, a repository had been initiated to collect projects and activities on how information and communications technology assisted stakeholders in everyday life and work and in combating challenges due to the pandemic. Forum 2022 was scheduled to start on 15 March 2022, with the final week to be held from 30 May to 3 June

²⁶ Mr. Peter Major, Hungary.

²⁷ Mr. David Souter, Managing Director, Information and Communications Technology Development Associates.

²⁸ Ms. Gitanjali Sah, Strategy and Policy Coordinator, Strategic Planning and Membership Department, International Telecommunication Union.

2022; components would include a forum track, a high-level track, 10 special tracks, talks, an exhibition space, two hackathons (on information and communications technology and indigenous languages; and designing a sustainable future using information and communications technology) and other events. Finally, the speaker noted that the regional commissions, the United Nations Group on the Information Society, other agencies and youth representatives had been collaborating with the International Telecommunication Union on Forum events, providing a good example of working together under the “One United Nations” initiative.

22. One speaker²⁹ detailed the work of the Office of the Secretary-General’s Envoy on Technology and its contributions to outcomes of the World Summit on the Information Society. The Secretary-General’s Envoy on Technology had been appointed in 2021 to guide the strategic approach to technology issues and serve as an advocate and focal point for digital cooperation. The core activities of the office focused on the implementation of the recommendations in *Road Map for Digital Cooperation*, under the three categories of connect, protect and respect, with the following main areas (with the corresponding action lines of the 11 action lines agreed for multi-stakeholder implementation of the outcomes of the Summit): universal connectivity (2); digital public goods (1, 3, 7); digital inclusion (8, 9); digital capacity-building (4, 7); digital human rights (9, 10); artificial intelligence (5); digital cooperation (6, 11); digital trust and security (5); and other areas (7). The report of the Secretary-General entitled “Our Common Agenda”, welcomed by the General Assembly,³⁰ set out a vision on the future of global cooperation and the reinvigoration of inclusive, networked and effective multilateralism, including with regard to technology.

23. Another speaker³¹ addressed the role of the Technology Bank for the Least Developed Countries in the implementation of and follow-up to the outcomes of the World Summit on the Information Society; and noted the socioeconomic benefits of better connectivity for the least developed countries. The Technology Bank worked across various action lines, particularly 3 and 4, and supported the enhancement of technological capacities in the least developed countries. Initiatives contributed to various action lines, including, for example, work on the role of public governance authorities and stakeholders in promoting information and communications technology for development. The speaker emphasized the need to enhance digital skills and the need for Governments, academia, the private sector and other stakeholders to prioritize digital inclusion and connectivity. He noted that, as a small organization, the Bank achieved impact through partnerships and, in this regard, highlighted relevant work undertaken with the International Telecommunication Union, UNCTAD, the United Nations Institute for Training and Research and the World Trade Organization in the areas of technology transfer, climate change, electronic commerce and digital connectivity.

24. One speaker³² presented an overview of the activities of the Internet Governance Forum in 2021 and actions taken to implement CSTD recommendations and the *Road Map for Digital Cooperation*. He advised that the Internet Governance Forum, to be held from 6 to 10 December 2021, would have two main themes, namely, human rights and economic and social inclusion, with four cross-cutting subthemes. Over 200 sessions were planned, under the following four groups: high-level tracks; parliamentary tracks; youth and newcomers; and community-organized sessions. In addition, social events, remote hubs and a village would be organized. Finally, the speaker noted that, with regard to the implementation of CSTD recommendations, the Internet Governance Forum was in the process of implementing changes in financing and was involved in over 130 national and regional initiatives.

²⁹ Mr. Jason Munyan, Programme Management Officer, Office of the Secretary-General’s Envoy on Technology.

³⁰ A/RES/76/6.

³¹ Mr. Moshe Kao, Programme Management Officer, Technology Bank for the Least Developed Countries.

³² Mr. Chengetai Masango, Head, Internet Governance Forum Secretariat.

25. Another speaker³³ detailed the work of the African Institute for Mathematical Sciences, a training institution established in Ghana in 2012 and in Rwanda in 2019, with the mission of bringing together the best graduate students from Africa with the best lecturers worldwide to help lead the digital transformation of Africa. Core programmes focused on mathematical sciences and research centres in related areas. In 2018, the Institute in Ghana had been designated a United Nations Educational, Scientific and Cultural Organization Centre of Excellence and it had partnerships with a number of leading enterprises. Over 2,000 students from 43 countries in Africa had been trained; most graduates had pursued a doctoral degree and some had gone into industry, and most had remained in Africa. The gender policy of the Institute aimed to ensure that over 30 per cent of students were women. Finally, the speaker noted that the Institute aimed to train 200 African graduate students in the next five years and expand research activities into artificial intelligence and the Internet of things.

26. During the ensuing interactive discussions, several participants noted persistent challenges that had not yet been fully addressed and addressed the road ahead with regard to reviewing the mandate and outcomes of the World Summit on the Information Society. One participant³⁴ noted that the review in 2025 would provide an opportunity to consider how the action lines might be adapted to reflect new opportunities and significant changes in society, including the pandemic and climate change; stated that the Internet Governance Forum had proved the most important forum for the discussion of Internet governance and policy issues; and noted that CSTD had a pivotal role to play in the review process. One delegate³⁵ stated that closer international cooperation had been acknowledged as critical in developing information and communications technology, policymaking and resource management; developed countries and international organizations had a pivotal role to play in ensuring the success of the World Summit on the Information Society and enhancing cooperation; and outcomes had not yet been fully realized, with Internet security, safety and stability still issues of concern, along with the persistent digital divide and limited progress in enhanced cooperation on Internet governance. Another delegate³⁶ stated that there was still a long path ahead, to reduce the digital gap between countries and facilitate the sharing of knowledge. The CSTD secretariat³⁷ noted that preparations needed to begin for the review in 2025, which would be comprehensive and take place in a different, more complex context than that in 2005, and suggested that regional group discussions should be initiated.

VII. Findings and suggestions

27. The following findings and suggestions on the two substantive themes were highlighted at the panel meeting and put forward for consideration by CSTD at its twenty-fifth session.

A. Industry 4.0 for inclusive development

1. Main findings

28. Industry 4.0 in manufacturing entails smart production, that is, integrating and controlling production using sensors and equipment, including traditional machinery and robots, cobots and three-dimensional printers, connected to digital networks supported by artificial intelligence. Many firms that have adopted smart production have achieved increases in productivity and a reduction in environmental impact. The impact of these technologies on employment has been a concern in some countries. However, empirical evidence suggests that the use of industry 4.0 technologies may create more jobs than it replaces. At the same time, an immediate concern is that most firms in developing countries,

³³ Ms. Adelaide Asantewaa Asante, Chief Operating Officer, African Institute for Mathematical Sciences, Ghana.

³⁴ Mr. Nigel Hickson, Head, Internet Governance Policy, Department for Digital, Culture, Media and Sport, United Kingdom.

³⁵ Representative of the Islamic Republic of Iran.

³⁶ Representative of the Dominican Republic.

³⁷ Ms. Shamika Sirimanne, Head, CSTD Secretariat.

in which economies are less diversified, are not yet utilizing such technologies but are mainly using analog technologies. Therefore, developing countries need to industrialize before they can broadly benefit from industry 4.0. On the other hand, countries should not miss out on the windows of opportunity for increasing productivity and sustainability offered through industry 4.0. Developing countries need to implement a dual strategy of continuing to diversify their economies and foster competitive manufacturing while, at the same time, creating the conditions for the emergence and diffusion of industry 4.0 technologies in their production bases.

2. Suggestions

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

(a) Foster economic diversification and manufacturing competency. Developing countries should consider placing economic diversification at the centre of national development strategies. Governments should design a national strategy for industry 4.0, which should include a shared vision and an appropriate mix of measures required to harness industry 4.0 effectively. In addition, policymakers should consider conducting foresight exercises and bringing together relevant agents of change and sources of knowledge to explore possible scenarios and develop strategic visions and intelligence to shape the future of national development;

(b) Create an enabling digital infrastructure. Governments in developing countries should create the conditions for affordable yet high-quality digital infrastructure to support the competitiveness of the private sector. This requires the mobilization of investment in information and communications technology infrastructure and the creation of a regulatory environment that enables competition in the telecommunications sector. In addition, Governments should promote initiatives to qualify and retrain the workforce and promote the use of industry 4.0 technologies in production chains;

(c) Foster innovation in industry 4.0 technologies. Governments should provide incentives for the private sector, including small and medium-sized enterprises, and entrepreneurs to use and develop applications using industry 4.0 technologies, including by facilitating the acquisition of hardware, software and tools needed for industry 4.0 solutions. In addition, policy instruments should aim to create an enabling environment for the emergence of markets for industry 4.0 solutions. For example, they could encourage the development of new projects through competitions or financing;

(d) Encourage the active involvement of stakeholders in the development of an industry 4.0 innovation ecosystem. Governments should create institutional spaces or mechanisms that bring together relevant partners to develop a shared vision for industry 4.0 and coordinate its implementation. Interventions should enable an industry 4.0 innovation ecosystem to emerge by linking academia and the private sector, including manufacturing and the digital and information and communications technology sector;

(e) Raise the awareness of the private sector. To help developing countries benefit from industry 4.0 technologies, Governments can set up meetings and activities to promote the benefits of industry 4.0. Such activities should build awareness of the modernization and skills needed in production and how these need not pose additional, high costs, but are necessary for competitiveness;

(f) Promote technological upgrading in manufacturing. Governments can help by promoting the industrial transformation to stakeholders in this sector. For example, countries could support the sharing of good practices, training in digitalization and making people aware of the new opportunities available to solve business problems more effectively. In addition, they could promote the development of cooperation platforms that help promote digital solutions in the business processes of companies, providing consultations and offering support tools;

(g) Build international partnerships. International partnerships are crucial in mobilizing resources and providing technical assistance on policy and a good policy mix, incentivizing the adoption of industry 4.0 technologies at the firm level and retaining and

developing talent. In addition, international collaborative projects on digital technologies are the most relevant for the development of industry 4.0 technologies.

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

(a) Collect and share success stories, including successful business cases, demonstrating the impact of industry 4.0 technologies on inclusive and sustainable development. In particular, the international community should disseminate examples and information that help guide how women and girls and those in marginalized communities can benefit from such technologies. CSTD can play a pivotal role in disseminating knowledge and best practices, establishing partnerships and sharing knowledge of success stories in various development contexts for the benefit of States;

(b) Contribute to creating a global centralized database of open-source technologies that could help solve local challenges with a broader range of available technological choices and applications. By categorizing such technologies according to their potential to contribute to achieving particular Sustainable Development Goals, such a database could accelerate discovery and innovation across all sectors associated with the Goals. Work on this database should be led by the United Nations, given its already established leadership role in advocating for open-source technology;

(c) Help design and implement national policies, strategies and programmes related to industry 4.0. The international community should support Governments in formulating national strategies and programmes for the use of industry 4.0 technologies. Technical assistance in this regard should make a systematic effort to involve a broad range of stakeholders, to ensure benefits from industry 4.0 without creating unintended and adverse socioeconomic effects and negative environmental externalities;

(d) Promote infrastructure development. The international community should support national infrastructure development required in the deployment of industry 4.0 technologies in production processes, such as digital infrastructure;

(e) Foster United Nations-wide efforts to support transnational cooperation between developed and developing countries in technology transfer and capacity-building; promote knowledge and technology transfer between developed and developing countries on industry 4.0 technologies; and support innovation actors from Member States in international networks and programmes to build their capacity in innovation for industry 4.0;

(f) Exchange knowledge and experience. The international community should facilitate the exchange of knowledge, research, experiences, success stories and best practices with leading policymakers, innovators and regulators in developed and developing countries; and encourage South–South cooperation to exchange knowledge and best practices. Support could be in the form of knowledge exchange and transfer, research and development projects and business matching and joint ventures. In addition, integration into international networks such as digital innovation hubs in Europe could contribute to the digitalization of firms in developing countries;

(g) Create joint programmes. The international community could help identify markets or market segments with greater demand for joint technological development. Such collaborative programmes can help facilitate technological and commercial exchanges, particularly with countries leading in such technologies. The international community should support developing countries in designing and implementing pilot programmes and initiatives in applying industry 4.0 in priority sectors;

(h) Scale-up capacity-building activities; and contribute to capacity-building activities at national and regional levels on industry 4.0 technologies, including creating online and hybrid training programmes for professionals and the general public;

(i) Support technological upgrading. The international community should support the upgrading of digital and non-digital industries to increase high-technology production and exports; and assist in benchmarking domestic industry firms against international firms that have achieved the transformation to industry 4.0;

(j) Develop ethical frameworks and guidelines. The international community should strengthen international cooperation to develop ethical frameworks and guidelines for

the adoption of industry 4.0 technologies. Innovation management standards have great potential to help developing countries and economies in transition to leapfrog into industry 4.0. Such guiding frameworks could be relevant for all types of organizations, including small and medium-sized enterprises.

B. Science, technology and innovation for sustainable urban development in a post-pandemic world

1. Main findings

31. The pandemic has led to many new forms of innovation for sustainable cities and communities. It has also triggered a level of research, development and experimentation that countries may struggle to implement in non-crisis conditions. The pace at which local and national leaders and stakeholders have reorganized urban sociotechnical systems in many regions by introducing innovative science, technology and innovation solutions to the challenges imposed by the crisis have been significant. It is now necessary to seize this innovation momentum and use its transformative power to ensure that urban areas can deliver on their commitment to sustainable urban development.

2. Suggestions

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

(a) Adjust pre-pandemic priorities and resource allocation strategies; review and redefine any existing sustainable urban development priorities to take into account the impact of the pandemic; and identify and invest in suitable science, technology and innovation solutions to alleviate unemployment and the financial issues experienced by low-income households and smaller firms;

(b) Cultivate and empower local ecosystems for urban innovation; frame an enabling institutional, policy-related and regulatory environment that promotes the development of an open innovation culture in urban spaces and facilitates cross-sectoral and multi-stakeholder collaboration; and expand incubation services to facilitate the transformation of business sector research in science, technology and innovation that actively helps solve urban development challenges;

(c) Build local capacity to deal with the complexity of urban digital transformation; provide local actors with the knowledge resources necessary to familiarize them with sustainable urban digital transformation and help them develop policy and governance capacity; and raise awareness among municipal governments and other local stakeholders of the non-evident complexity of technology-related urban development strategies and the importance of integrating local context conditions with a people-centred focus in urban sustainability actions;

(d) Introduce new and more equitable financing mechanisms; facilitate cross-sectoral collaborative ventures with heterogeneous actors to increase the financial capacity of cities and urban communities to support the research and development actions required to embrace science, technology and innovation solutions; and strengthen institutional settings to ensure that public investment management in cities and communities is supported by policy coherence across multiple levels of governance;

(e) Rethink urban areas as data infrastructures; transform existing data governance structures to ensure a more systemic, human-centric, cross-collaborative and privacy-preserving approach to the management and development of urban data infrastructures; and ensure that cross-sectoral and multi-stakeholder collaborative ecosystems support data governance structures;

(f) Take an integrated approach to policy setting for sustainable urban development; help local development actors embrace the integrated approach to urban sustainability enhancement championed in the 2030 Agenda for Sustainable Development and the New Urban Agenda; and adjust institutional frameworks to integrate urban sustainability policy settings, horizontally and vertically, and ensure the coordination needed

to maximize synergies among science, technology and innovation-related actions and minimize fragmentation and trade-offs;

(g) Build capacity with regard to digital mindsets, skills and technology acceptance; build consensus and strengthen collaboration on digital education strategies; and increase innovation and investment in digital technology for learning and teaching.

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

(a) Introduce financial measures that can help reinstate the financial stability of private and public sector organizations, particularly in developing economies; and enhance international support by mobilizing additional financial resources for developing countries from multiple sources;

(b) Support cross-country collaborative research efforts by establishing common strategies for data collection and analysis that can facilitate benchmarking; and mobilize the resources required to increase the international availability of urban disaggregated data to obtain localized knowledge on the functioning of urban sociotechnical systems and prepare appropriate science, technology and innovation solutions;

(c) Ensure a cross-sectoral harmonization of urban sustainability policies across governmental levels, from local to global; and establish a virtual environment to facilitate international knowledge transfer and ensure that a global body of experience is available for all;

(d) Assist developing countries in structuring long-term collaborative efforts that extend beyond single projects and look at multi-year developments; and provide countries with guidance on how to develop effective local and national regulatory frameworks;

(e) Enhance capacity-building support to increase the availability of resources for scaling up research development capacity in response to an emergency condition; mobilize resources for supporting more research exploring the non-technological dimensions of digital transformations for urban sustainability; and ensure that research and development efforts towards sustainable urban development receive adequate financial support in all regions, particularly those with the greatest need;

(f) Develop operational tools that consider the place-based and sociotechnical components of technology-related sustainability transitions to stop the spread of one-size-fits-all mentalities;

(g) Strengthen scientific cooperation in the field of digitally enhanced teaching and learning to provide Government leaders and local authorities with more guidance; and encourage the reframing of national education systems to ensure that digital literacy and digital technologies become a central component of existing and future school curricula, at all levels, from pre-primary schools to universities.
