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ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT (CSTD)**

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Contribution by ITU

to the CSTD 2021-2022 priority themes on “Industry 4.0 for inclusive development”
and “Science, technology and innovation for sustainable urban development in a
post-COVID world”

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ITUs contribution to the 24th Annual Session of the United Nations Commission on Science and Technology for Development (CSTD) priority themes

PRIORITY THEME 1: Industry 4.0 for inclusive development

1. Could you share national strategies, policies, laws, programmes and initiatives concerning Industry 4.0 concerning your member countries?

- ITU has established a number of ITU-T Focus Groups that impact in the technology needed for Industry 4.0 and its environmental impact including:
 - [ITU-T Focus Group on "Environmental Efficiency for Artificial Intelligence and other Emerging Technologies" \(FG-AI4EE\)](#)
 - [ITU-T Focus Group on AI for autonomous and assisted driving \(FG-AI4AD\)](#)
 - [ITU-T Focus Group on Autonomous Networks \(FG-AN\)](#)
- [ITU-T Study Group 20](#) is working to address the standardization requirements of Internet of Things (IoT) technologies, with an initial focus on IoT applications in smart cities and communities (SC&C). SG20 develops international standards to enable the coordinated development of IoT technologies, including machine-to-machine communications and ubiquitous sensor networks. As such, ITU-T Study Group 20 is developing the basis for IoT which forms a basis for Industry 4.0.
- [WSIS Forum](#) serves as a ready platform to showcase examples of projects/policies in organizations helping countries undertake transition towards urban sustainability so that cities are productive, inclusive, and liveable. Events related to the topic are witnessing an increased number of sessions and workshop that discuss the impact of ICTs on Industry 4.0 and vice-versa, organized by WSIS stakeholders and ITU membership sharing national strategies, policies, laws, programmes and initiatives concerning Industry 4.0.
- [WSIS Stocktaking](#) database, coordinated by ITU since 2004, has collected more than 40 ICT-related national strategies, policies, laws, programmes and initiatives that have reflected upon or contributed to development of Industry 4.0 with some of them recognized as the winners or champions of the [WSIS Prizes](#) contest.
- ITU-D is currently supporting countries (Burundi, Namibia and Malawi) in the development of national e-waste management policies. Additional countries will be added to this list shortly (Bahrawin, Mauritania, The Gambia and Botswana). ITU-D is also supporting one country (Dominican Republic) in the development of a national e-waste management regulation. Putting these policies and laws in place will help countries to prepare, from a circular economy perspective, for the potential waste arising from the roll out of technology associated with Industry 4.0.
- ITU-D is also supporting countries of (Mali, Niger, Trinidad and Tobago, Oman, Serbia, Georgia) in the development of ecosystem based strategies and recommendation to inform national policies. Through technical assistance for country reviews, there are three expected results: the formulation of a national start-up act or programme through updated ICT policies that include the pillars of innovation and entrepreneurs, informing the national development plan and key flagship enabler programmes for digital innovation/entrepreneurship that realizes national priorities, and developing specific initiatives from a comprehensive roadmap such as digital transformation ecosystem accelerators or other key recommended programmes and projects.

2. What are the challenges that governments have faced or may face for promoting Industry 4.0, to contribute to national development priorities and accelerate the progress towards the SDGs?

Governments will face the issue of increasing amounts of e-waste and its management from the use of increasing digital technologies.

[ITU-T Study Group 5 \(SG5\)](#) is responsible for studies on methodologies for evaluating ICT effects on climate change and publishing guidelines for using ICTs in an eco-friendly way. Under its environmental mandate SG5 is also responsible for studying design methodologies to reduce ICTs and e-waste's adverse environmental effects, for example, through recycling of ICT facilities and equipment.

Governments will also face the potential consequences of lapses in cyber security and its impact on industry and its ability to supply consumers, as more of industry becomes based on Industry 4.0 and connected to the cloud and to a vast array of sensors. Industry 4.0 takes the emphasis on digital technology from recent decades to a whole new level with the help of interconnectivity through the Internet of Things (IoT), access to real-time data, and the introduction of cyber-physical systems.

This heterogeneous environment, while it promises great advances in the way the services and applications are provisioned, and in the way systems are managed, administered, and maintained, yet comes with a very wide range of sector-specific risks and threat vectors. Implications for security, privacy and the overall trust of use, adoption, and proliferation of IoT, and devices, systems, services, applications, and platforms could hinder its overall market development. Therefore, it is important that security and privacy concerns are taken into account throughout the design process of products and systems to be used in IoT implementations commonly known as privacy by design and security by design, which emphasize that protection be built into information technologies, business practices, systems, processes, physical design, and networked infrastructure.

[ITU-T Study Group 20](#) is developing a series of standards and guidelines on security, privacy, trust, and identification for IoT which offer a more comprehensive, interlinked, secure and holistic approach to manufacturing.

New and emerging technologies have the potential to contribute towards the achievement of the UN Sustainable Development Goals. If leveraged correctly, they can help address issues across diverse sectors such as health, education, employment, environment, transportation, agriculture, nutrition, disability, youth empowerment, social inclusion, gender equality and poverty reduction. However, this transformative potential comes with both significant opportunities and complex policy challenges in various social, economic, technical, environmental and developmental fields. Policy-making in this respect is critical for facilitating efforts, particularly in developing and least developed countries. Key considerations for policy makers include infrastructure needs, investment, regulatory environment, training and skills development, market environment, institutional cooperation, the role of development aid etc.

New and emerging technologies can also cause disruption to the systems in place that are designed to manage them in a sustainable manner once they have reached the end of their life and use, i.e. when they become e-waste. For example, the miniaturization and embeddedness of ICTs is creating challenges for the sorting, dismantling and processing of these technologies once they are discarded by their owners.

Many countries are challenged with immature digital innovation ecosystem which prevents leveraging technological revolutions. There are three main challenges facing countries and key ecosystem stakeholders (entrepreneurs, entrepreneurial support networks, the private sector, the public sector, financiers and academia) in integrating ICT/telecommunication innovations into their national development agendas:

- Insufficiency of appropriate policies, programmes, resources and knowhow for innovators and digital change-makers to accelerate digital development in their communities;
- Lack of understanding of the systemic issues in the environment hindering digital transformation; and
- Lack of collaboration between stakeholders to deliver impact-driven initiatives for national development priorities.

3. What should governments, the private sector, labour unions and other stakeholders do so that developing countries can benefit from these technologies?

Develop the guidelines on implementation and summary of already implemented solutions. Samples in ITU-T Supplements:

- Y.Suppl.46 "[ITU-T Y.3500-series - Requirements and challenges regarding provision and consumption of cloud computing services in developing countries](#)"
- Y.Suppl.64 "[ITU-T Y.3100-series - Awareness on use cases and migration aspects of IMT-2020](#)"
- Y.Suppl.65 "[ITU-T Y.3600-series - Big data adoption in developing countries](#)"

It is key for developing countries to be assisted in the development of policies and best practices for Industry 4.0 that will ensure that they received the benefits (e.g. increased productivity, lower consumption of resources, decreased costs) while avoiding potential negative impacts (e.g. e-waste, cyber security, data privacy)

Stakeholders will also need to ensure that standards are developed to manage all aspects of Industry 4.0 (e.g. Sensors, AI, Blockchain, 5G networks)

Stakeholders need new approaches to understanding and diagnose their ecosystem issues, update their policies and programs and ensure the right collaboration mechanism to accelerate achievement of the sustainable development goals.

4. What actions can the international community, including the CSTD, take to help countries take advantage of Industry 4.0 for inclusive and sustainable development?

ITU has published numerous international standards (ITU-T Recommendations) that are related to Industry 4.0, IoT, etc., that are available for free download and use by developing countries. It is this focus on the availability of free standards that allows developing countries to have the information needed to develop and implement the infrastructure needed for Industry 4.0. Additionally, ITU organizes events in different regions which allow countries to get new knowledge. Furthermore, ITU work with developing countries to bridge the standardization gap and help them to be more involved in standardization activities.

The sixth [World Telecommunication/ICT Policy Forum \(WTPF-21\)](#) is a high-level international event where ITU Members and other stakeholders come together to exchange views on the key policy issues arising from today's fast-changing information and communication technology (ICT) environment. The theme of WTPF-2021 is "Policies for mobilizing new and emerging telecommunications/ICTs for sustainable development: The WTPF-21 would discuss how new and emerging digital technologies and trends are enablers of the global transition to the digital economy. Themes for consideration include AI, IoT, 5G, Big Data, OTTs etc. In this regard, the WTPF-21 will focus on opportunities, challenges and policies to foster sustainable development.

ITU and UNIDO signed a Joint Declaration to collaborate on the advancement of the 2030 Agenda for Sustainable Development, especially SDG9 on Industry, Innovation and Infrastructure. This is an action-oriented partnership that aims to build coalitions and drive collaboration that catalyse country-level programming that deliver concrete contributions towards achieving SDG9. For more information, please visit the following page:

<https://www.itu.int/en/sustainable-world/Pages/SDG9-WSIS-Session.aspx> |

Invite Stakeholders to contribute to the [WSIS Forum 2022](#) Open Consultation Process to include the topics in the Agenda of the WSIS Forum 2022, and network, learn and share on this theme.

Invite Stakeholders to contribute to the [WSIS Stocktaking Repository](#) and submit to the [WSIS Prizes 2022](#) contest aligning the theme with the WSIS Action Lines and SDGs.

Stakeholders should work together to create sustainable national policies and laws, whether they are industrial or waste related, using a whole-of-ecosystem approach in order to move through the Fourth Industrial Revolution without creating negative environmental externalities – such as through the generation of e-waste from new and greater numbers of technologies.

5. Could you suggest some contact persons responsible for projects/policies and international collaboration in this context as well as any experts (from academia, private sector, civil society or government) dealing with projects in this area? We might contact them directly for further inputs or invite some of them as speakers for the CSTD inter-sessional panel and annual session.

Please contact WSIS Team for further coordination: Vladimir Stankovic (vladimir.stankovic@itu.int) (ITU) – Program Coordinator (WSIS)

6. Do you have any documentation, references, technological assessments, future studies or reports on the priority theme?

ITU-D has published the [Global E-waste Monitor 2020](#) which assessed the quantities, flows, and the circular economy potential of e-waste.

ITU-D has also published a toolkit on [Policy Practices for E-waste Management](#) which presents tools for fair and economically viable extended producer responsibility in the management of e-waste.

ITU-D publications on digital innovation ecosystems are available on the topic and the latest toolkit can be found at [Bridging the Digital Innovation Divide: A toolkit for developing sustainable ICT-centric ecosystem projects](#) is a good read for the topic and the approaches.

ITU-T SG13 has 6 flipbooks on the technological areas of value for Industry 4.0. All are available from the SG13 homepage (<https://www.itu.int/en/ITU-T/studygroups/2017-2020/13/Pages/default.aspx>), *Special Topics* ribbon on the right. Outputs of the ITU-T FG NET2030 may also be included: <https://www.itu.int/en/ITU-T/focusgroups/net2030/Pages/default.aspx>.

Technical report “Driving Forces and Vision towards Network 2030”: <https://www.itu.int/pub/T-TUT-NET2030-2020>.

ITU-T has published numerous international standards (ITU-T Recommendations) that are related to Industry 4.0, IoT, etc.

These standards can be found at:

ITU-T Recommendation L-Series: [Environment and ICTs, climate change, e-waste, energy efficiency; construction, installation and protection of cables and other elements of outside plant](#)

ITU-T Recommendations X-Series: [Data networks, open system communications and security](#).

ITU-T Recommendations Y-Series: [Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities](#)

Also relevant to report are the ITU-R reports:

- Report ITU-R M.2479-0 - The use of land mobile systems, excluding IMT, for machine-type communications:
 - o https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2479-2019-PDF-E.pdf.
 - o Highlights in its annex several Wireless industrial automation applications
- Report ITU-R M.2441-0 - Emerging usage of the terrestrial component of International Mobile Telecommunication (IMT):
 - o https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2441-2018-PDF-E.pdf
 - o Provides several use cases and applications (e.g. smart cities, smart homes, agriculture etc)

UNIDO and ITU are partnering up for the development of innovation policies, broadband Internet infrastructure and to enhance countries’ strategies towards the digital transformation connecting the “unconnected”. Under the UNIDO–ITU Joint Declaration, signed in 2017, key areas of cooperation include the development of international ICT standards, facilitation of interoperability, and reduction of the digital divide: <https://www.itu.int/en/sustainable-world/Pages/SDG9-WSIS-Session.aspx>

Please see websites of WSIS Forum, WSIS Stocktaking, WSIS Prizes, UNGIS for publications, joint statements and other activities with multistakeholders on the priority theme.

PRIORITY THEME 2: STI for sustainable urban development in a post-COVID world

- 1. Can you give examples of projects/policies in your organization helping countries undertake transition towards urban sustainability so that cities are productive, inclusive, and liveable? What are the main challenges confronted while trying to implement these projects/policies?**

Technical challenge to interconnect a big amount of smart, portable and wearable devices concentrated on a given territory (density of devices is very high per km²).

Based on our experience, one of the main challenges cities are facing when implementing digital technologies in response to the global pandemic and for sustainable development is the need to measure progress and align development strategies with the SDGs. [United for Smart Sustainable Cities](#) (U4SSC) is a UN initiative coordinated by ITU, UNECE and UN-Habitat and supported by other 14 United Nations agencies and programmes to achieve Sustainable Development Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable". U4SSC has developed [the Key Performance Indicators \(KPIs\) for SSC](#) to support countries and cities in measuring the performance of their digital strategy. Each KPI is also uniquely connected to one or multiple SDG indicators and targets. Therefore, implementing the KPIs would not only provide countries and cities with valuable data and reference points to refine their digital strategies and set new milestones that will help accelerating sustainable development. Over 150 cities have already partnered with U4SSC in implementing these indicators. By implementing these KPIs, cities have been able to identify their areas of opportunities and take the necessary actions. Examples of cities that have implemented these KPIs is available [here](#). In response to the global pandemic, U4SSC has also created [a thematic group on "economic recovery in cities and urban resilience building in the time of Covid-19"](#).

Additionally, ITU is assisting Costa Rica and Argentina in the implementation of two ITU standards (ITU-T L.1031 "Guideline for achieving the e-waste targets of the Connect 2030 Agenda" and ITU-T L.1032 "Guidelines and certification schemes for e-waste recyclers") as part of the UNIDO-GEF project on "Strengthening of National Initiatives and Enhancement of Regional Cooperation for the Environmentally Sound Management of Persistent Organic Pollutants (POPs) in waste electrical and electronic equipment (WEEE) in Latin American Countries. Some of the challenges found is the disposition of stakeholders to share data and provide information.

[WSIS process, including WSIS Forum, WSIS Stocktaking, WSIS Prizes](#) and its many special initiatives serve as examples of sharing best practices and discussing how ICTs are helping countries undertake transition towards urban sustainability so that cities are productive, inclusive, and liveable.

As a part of the WSIS Stocktaking process ongoing efforts (coordinated by ITU) to promote the good use of ICTs in making social impact, and in order to provide useful, replicable and actionable information to all WSIS community and beyond, a new repository was launched in April 2020 - [WSIS Stocktaking Coronavirus Response – ICT Case Repository](#) - that has been collecting projects and activities on how ICTs are assisting stakeholders in their everyday life, work, and combating challenges caused by the pandemic, including the impact on sustainable urban development.

WSIS Forum 2021 conducted several workshops on the theme of Smart Cities, including a high-level session entitled [Inclusive and responsible digitalization](#) in the city engaging Mayors. Following the success of this session WSIS Forum 2022 will organize a Mayor's meeting to further discuss this important topic.

- 2. In your organization's view, how has the Covid-19 pandemic so far impacted on sustainable urban development, and what lessons could we draw from the Covid-19 pandemic on sustainable urban development?**

The global pandemic has highlighted the importance of digital technologies. At the same time, it has also exposed the weaknesses of local management and health systems in cities as well as their ability to respond to emergency situations. The main lesson we could draw from the pandemic experience is that digital technologies, or STI, are a mean to achieve urban sustainability not a goal. Meaning that the global community needs to work together to build capacity and facilitate global learning that emphasize on solving common challenges, such as interoperability, and aligning sustainable urban development with the SDGs. ITU standards are developed with these values in mind.

The pandemic has changed our lives forever and brought the importance and potential of ICTs and emerging technologies ranging from AI to 5G to the fore. But it has also shone a light on deep digital inequalities between and within countries at a time when overall growth is slowing and worrying gaps in connectivity and access persist, especially in rural and underserved areas. In the last edition of special report, that came out as result of the newly launched WSIS Stocktaking Coronavirus – ICT Case Repository, more than 400 ICT projects showcase how WSIS stakeholders rose to the challenge, featuring ICT projects and initiatives from governments, private sector companies, academia, civil society, international organizations, and others. This form of crosssector collaboration and best-practice sharing is the essence of the WSIS Stocktaking process, and it is exactly what is needed to defeat COVID-19 and advance the WSIS Action Lines in support of the SDGs.

The COVID-19 crisis has not only highlighted the critical role of information and communication technologies (ICTs) for continued functioning of societies but has also brought to the fore the startling digital inequalities between and within countries. Bound by the powerful belief that technology can be a source of good for everyone, ITU Members have stepped up and engaged in activities that have proven essential in saving lives and keeping economies going. ITU is helping countries to fully utilize digital technologies to respond to and recover from COVID-19, and to build preparedness for similar future global emergencies. Now more than ever, the world needs to be able to rely on ICTs and ITU's leadership in promoting universal, secure, reliable and affordable connectivity. Consult the list of its COVID-19 initiatives, activities and partnerships [here](#), and read core COVID-19 messages [here](#).

3. Could you share specific examples, projects or initiatives that have used science, technology, and innovation (STI), including frontier technologies (e.g., AI, drones, blockchain, 3D printing, etc.) or other forms of innovation in general in addressing the above challenges in relation to urban sustainability transition?

Machine Learning to help autonomous driving.

ITU has provided significant support to countries and cities to leverage STI for sustainable development through standardization. For examples, [ITU-T Study Group 20 on "Internet of Things, Smart Cities and Communities"](#) has developed [Recommendation ITU-T Y.4470 "Reference architecture of artificial intelligence service exposure for smart sustainable cities"](#) which defines the high-level requirements and reference architecture for AI services in smart cities and communities. The group has also developed [a series of standards](#) that define the framework and architecture for blockchain-based data management in cities. In addition, Study Group 20 has drawn expertise from [its diverse membership](#) and developed standards that define the IoT requirements of different city functions, including, smart manufacturing, digital health, supporting edge computing, strengthening IoT ability to process real time information for earth monitoring, improving accessibility of STI and more. In response to Covid-19, the group is also working to develop new health standards that will support e-health services in case of emergencies. Each of these standards can support countries and cities in their sustainability transition.

In addition, [the ITU-T Focus Group on "Environmental Efficiency for Artificial Intelligence and other Emerging Technologies"](#) (FG-AI4EE) is also working to identify the standardization requirements of implementing AI and other technologies in an environmentally conscious manner.

Additionally, Recommendation ITU-T L.1381 "Smart energy solution for data centres" developed by ITU-T Study Group 5: Environment, Climate change and circular economy, provided guidance to improve energy efficiency of data centres in China. There is indeed an urgent need to focus on the energy aspect of technology itself. As a result of the implementation of the standard, the power usage effectiveness of a data centre in this case is reduced to 1.15 and the annual electricity expense is also reduced by 12.2%. 4.91 million kWh of electricity with 2215 tce/a of energy being saved every year, reducing carbon dioxide emissions by 4724 tons.

[WSIS Stocktaking](#) database, coordinated by ITU since 2004, has collected more than 100 ICT-related examples, projects or initiatives that have used science, technology, and innovation (STI), including frontier technologies (e.g., AI, drones, blockchain, 3D printing, etc.) or other forms of innovation in

general that have reflected upon or contributed to urban sustainability transition with some of them recognized as the winners or champions of the [WSIS Prizes](#) contest.

4. Can you provide examples of policies/projects/initiatives specifically aimed at strengthening national STI capabilities to promote urban sustainability transition?

ITU smart city standards have provided authentic guidance for strengthening national and local STI capabilities to promote urban sustainability transition. For examples, Recommendations [ITU-T Y.4904 “Smart sustainable cities maturity model”](#) and [Y.4905 “Smart sustainable city impact assessment”](#) are providing guidance for cities the mean to determine their STI capabilities and adopt the right approach to sustainability transition through digital transformation. [Recommendations ITU-T Y.4200](#) and [Y.4201](#) provide technical guidance for defining the interoperability requirements of smart city platforms. They are critical for facilitating vertical integration and scaling up IoT solutions for sustainability transition. In addition, the U4SSC KPIs for SSC are developed based on the ITU standard [Recommendation ITU-T Y.4903/L.1603 “Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals”](#), which has played a significant role in strengthening countries and cities’ STI capabilities and aligning them with the SDGs. Moreover, ITU has recently initiated [the ITU webinar series on digital transformation and smart cities and communities](#). Consisting of 12 webinars, this series aims to strengthen STI capacity by facilitating global learning on key urban topics and the role of digitalization in the process.

5. Could you share case studies of regional and international cooperation that have strengthened STI capacities of developing countries in dealing with urban sustainability transition?

As mentioned above, the U4SSC KPIs for SSC have supported over 100 cities in measuring and strengthening their STI capacity and strategy. Many of which are from developing regions, including [Santa Fe in Argentina](#), [Bizerte in Tunisia](#), [Moscow in Russia](#), and more. A full list of related case studies and publications can be found [here](#). In addition, the ITU smart city standards mentioned are also widely adopted by different developing countries. For examples, [ITU-T Y.4904 “Smart sustainable cities maturity model”](#) and [Y.4905 “Smart sustainable city impact assessment”](#) were both adopted by Brazil and Ecuador.

6. Could you suggest some contact persons responsible for projects/policies, related technologies and international collaboration in this context as well as any experts dealing with projects in this area? We might contact them directly for further inputs or invite some of them as speakers for the CSTD inter-sessional panel and annual session.

Please contact WSIS Team for further coordination: Gitanjali Sah (Gitanjali.sah@itu.int) (ITU) - Strategy and Policy Coordinator (WSIS)