REPUBLIC OF KENYA

REPORT ON KENYA'S PARTICIPATION IN THE COMMISSION ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT INTER-SESSIONAL PANEL MEETING HELD IN GENEVA, SWITZERLAND FROM 25TH TO 26TH OCTOBER 2022

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26th October 2022

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EXECUTIVE SUMMARY

The Commission on Science and Technology for Development (CSTD) is a subsidiary body of the Economic and Social Council and the United Nations focal point for science, technology and innovation (STI) for development, in analyzing how STI, including information and communications technologies (ICTs), serve as enablers of the 2030 Agenda. The Commission acts as a forum for strategic planning, sharing lessons learned and best practices, providing foresight about critical trends in STI in key sectors of the economy, the environment and society, and drawing attention to emerging and disruptive technologies. While the membership of the CSTD is composed of 43 States, its discussions also involve civil society representatives, academia and the private sector. Strong links exist with other UN bodies (i.e., Commission on the Status of Women, Commission on Social Development, ITU, Regional Commissions, UNESCO). The UN Conference on Trade and Development (UNCTAD) hosts the Secretariat of the CSTD which meets annually in Geneva.

Every year, the commission has two priority themes. For the twenty-fifth session, the priority themes were: Industry 4.0 for inclusive development; and Science, technology and innovation for sustainable urban development in a post-pandemic world. For the twenty-sixth session of 2022-2023, the intersessional panel addressed the following two priority themes;

Theme 1: Technology and Innovation for cleaner and more productive and competitive production;

Theme 2: Ensuring safe water and sanitation for all: A solution through science, technology and innovation

Participants during the twenty-sixth session of 2022-2023 included representatives from national Governments, international organizations, the private sector and civil society. Representatives of other organizations, including non-governmental organizations in the general and special categories, who hold consultative status with the Economic and Social Council or have received accreditation from the World Summit on the Information Society were also participated.

This report covers deliberations on the two themes as well as related matters including the mechanisms of deploying Science, technology and innovation for sustainable urban development in the wake of Pandemics.

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1.0 Preamble

The world is far from attaining resource efficient, safe, and inclusive urban areas, where anyone can benefit from environmentally friendly and prosperous economies and high-quality public goods and services. The overall impact of COVID-19 has exacerbated existing sustainability challenges, exposing the vulnerability and inefficiencies of urban systems worldwide. Fostering more sustainable urban futures requires government leaders and other stakeholders to reorganize the functioning of urban sociotechnical systems. Housing, energy, water, mobility, waste management, economic prosperity, urban planning, gender equality, safety and security and protection from natural disasters are all examples of urban sociotechnical systems that serve urban communities. However, under the pressure exerted by exogenous forces – such as increasing urbanization, demographic changes, climate change, and unstable economies – ensuring the sustainable functioning of urban sociotechnical systems have become increasingly difficult.

In a world in which societies and economies are increasingly relying on science, technology, and innovation (STI) advancements, including digital technologies, STI must play a central role in building a better future and sustainable urban areas in the aftermath of COVID 19 pandemic. The Commission on Science and Technology for Development inter-sessional panel meeting held from the 25th to 26th October 2022 in Geneva, Switzerland deliberated on two priority themes, namely: Theme 1- on Technology and Innovation for cleaner and more productive and competitive production; and Theme 2 on Ensuring safe water and sanitation for all: A solution through science, technology and innovation. Related matters were also discussed including the mechanisms of deploying Science, technology and innovation for sustainable urban development in the wake of Pandemics

2.0 Technology and innovation for cleaner and more productive and competitive production

2.1 Concepts, Characteristics and Impacts of Green Technology

In is envisaged that Green Technology have the great potential to help the global community to enhance resilience in the wake of COVID-19, and also to bring about the transformations needed to achieve the SDGs, reduce poverty, tackle climate change and put the world on a sustainable path. Critical areas for innovation in this new technological revolution are renewable energy technologies and frontier technologies for sustainable production and consumption which could help diversify economies and create higher-wage jobs while protecting the planet. There are sound environmental, social and economic reasons to support the development, diffusion and implementation of green technologies.

There is not a commonly accepted or internationally agreed definition of green technology. The term can be broadly defined as technology that has the potential to significantly improve environmental performance relative to other technologies. It is related to the term "environmentally sound technology", which was adopted under Chapter 34 of Agenda 21. In general, green technologies are considered those that "protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual waste in a more acceptable manner than the technologies for which they were substitutes." Technologies for cleaner production may take two forms, viz: 1) energy technologies that are greener and used to power the production; and 2) technologies for process improvement, e.g., reduction of energy or materials usedper unit of output which can be achieved with the introduction of new technology. These green energy forms may realized through: Green energy, power (the greatest environmental benefit); Renewable energy (an unlimited source of power); Sustainable energy which is replenished faster than the speed of depletion; and Clean energy with zero emissions.

The concept of green innovation should embrace new solutions that may help recover some of the highly stressed or damaged elements of eco-systems, e.g., absorbing CO^2 from the atmosphere or bioremediation to restore contaminated soils or water bodies. Green technology innovation is also associated with significant environmental challenges such as climate change mitigation and adaptation, biodiversity conservation, outdoor and indoor pollution, clean water access, and liquid and solid waste. Alongside green technologies to tackle these issues, several technologies are not strictly "green" but will be necessary to achieve the green transition. These include digital technologies such as artificial intelligence, the internet of things and blockchain.

2.2 Trends affecting green technology and innovation

It is observed that the North-South divide in Science, Technology and Innovation (STI) is widening where available data indicates that the widening gap between the developed and developing countries as pertains to the input side of national innovation systems (NIS). Many countries of the EU strive to reach 3 per cent of R&D expending as a percentage of GDP or achieve this value (e.g. Germany and Denmark), while the top global performers invest 5 per cent of GDP in R&D (e.g. Israel and the Republic of Korea). On the other hand, only a few developing countries approach or surpass the 1 per cent level (e.g. Brazil., Egypt, Türkiye) while R&D expenditure in the majority of developing countries ranges between 0.5 per cent and 1 per cent (e.g. South Africa and Viet Nam), and others stay below, among them even some OECD countries, e.g. Mexico (0.3 per cent) and Colombia (0.3 percent). Similarly, there is a widening gap concerning the percentage of researchers per million inhabitants of a country, which is a second important indicator on the input-side of the national innovation system. The North-South gap is also evident on the output side of national innovation systems, as illustrated by the number of scientific and technical papers annually published in journals. There is evidence that even in fields highly relevant to the Global South and global challenges, most science is carried out, and its agenda is defined, in the North. Accordingly, sustained efforts for inclusivity is necessary if success is to be attained worldwide. Further, Climate change is a global issue; thus, technological innovations to address this threat might increasingly be generated on the transnational or even global level. To date, regional STI cooperation is not gaining sufficient traction in developing regions to build a solid joint basis for using Green Technologies for sustainable development.

2.3 Development, adoption and production of renewable energy technologies

Based on empirical evidence, green windows of opportunities in developing, adopting and producing renewable energy technologies are often institutional. Although demand conditions and technological changes also influence these green windows of opportunity, they are often promoted by public actions and related adjustments to the institutional framework conditions. Further, creating a domestic market is another crucial element of the institutional windows of opportunity. In this respect, renewable energy sectors differ from many 'non-green' consumer or capital goods sectors, where government-led demand creation is the exception rather than the rule. There is need to encourage a shift of research for green innovations from the national to the multilateral level, including open innovation approaches. It has been observed that Agricultural Programmes that are Internationally financed, located mainly in developing countries, intensively embedded in multi-stakeholder networks and with a clear common goods approach have proven to contribute to innovative solutions for a climate smart, innovative and socially inclusive agriculture.

Open-source technologies can also provide a means of effective international collaboration on innovation. Countless open-source designs and technologies are shared by innovators worldwide, yet there is currently no central repository of such technologies, making it difficult for producers in developing countries to locate, access and incorporate them in their innovations. In this regard, the Economic and Social Council of the United Nations recently adopted resolution 2021/30 on opensource technologies for sustainable development. This resolution calls for building and sharing the creation of a centralized repository of open-source technical information as a global stock of knowledge to help developing countries towards sustainable development. The success of such a database will depend on solid support from Member States of the United Nations, and on collaboration and cooperation among United Nations agencies

2.4 Technology transfer for the sustainability and resilience transformation

Given the urgent climate and environmental crises, the question of how sustainable technologies can be accelerated not only in the most advanced but also in developing countries has gained momentum. The lack of advanced technologies and related capabilities to use them has been seen as a core reason for developing countries' lack of socio-economic dynamics. Also, access to technology became an element of concepts for an environmentally sustainable world. The question of technology transfer is embedded in the more complex issue of building-up innovative capabilities: the capacities to adopt, adapt, develop, deploy and operate technologies under varying societal and environmental contexts. Successful technology transfer does not only require willingness and abilities by the providers of technology, but also, on the side of technology receivers, it requires absorptive capacity, human capital, trust, social connectedness, prior experience with partnerships, and international experience.

Only if local actors acquire certain "know-why" capabilities, a country can be able to adapt a given set of technologies to varying framework conditions and apply it beyond the usage for which it was transferred initially. These capabilities are crucial for green technologies, as their deployment often within and across countries needs adaptations to specific conditions on the ground. In addition, some green innovations have still not reached complete technological maturity and require significant adaptive research to allow a large-scale roll-out, envisaged and required to achieve real impact in mitigating climate change and other environmental degradation. Enabling and empowering developing countries to take advantage of green windows of opportunities requires, thus, broad and comprehensive development strategies to support national innovation systems.

3.0 Ensuring Safe Water and Sanitation for All: A Solution by Science, Technology, and Innovation

3.1 STI for Safe Water and Sanitation: Current opportunities and challenges

Access to safe water and adequate sanitation is a basic human right. While progress has been made towards the achievement of the Sustainable Development Goal on water and sanitation

(SDG 6), the trends and current status of access to water and sanitation provides cause for concern. There is urgent need to devise solutions that accelerate progress and ensure that no one is left behind. Nearly every other Sustainable Development Goal relies in some way on the achievement of SDG 6. For example, together with good hygiene practices, it is essential for the achievement of good health and well-being as well as equality and empowering of women and girls. As a determinant of success in areas including agriculture, energy, and disaster resilience, it has vast socio-economic impacts.

Whilst factors such as improving policies and governance, increasing funding, improving infrastructure, and improving data availability for better decision-making are likely to be central to resolving the water and sanitation issues, there is no doubt that Science, Technology, and Innovation (STI) can play a particularly significant role. The COVID-19 pandemic has demonstrated the vital role of STI in delivering solutions to critical challenges. Countries are more attentive now to the development and deployment of new technologies and processes. New applications of existing technology and techniques have the potential to increase the efficiency of existing water and sanitation systems to secure water and sanitation for all. For example, STI for water has been the centre of attention in much of the discussion at international water policy events. Indeed STI is key enabler for catalytic actions toward achieving universal access to safe water and sanitation.

3.2 Progress in implementing SDG 6

SDG 6 calls for ensuring universal access to safe and affordable drinking water and sanitation, the provision of hygiene, and ending of open defecation. Important within this goal is the recognition that sustainably managing water goes far beyond simply providing safe water supply and sanitation services. It requires addressing the broader water context, such as improving water quality and wastewater management, improving water use efficiency in order to use freshwater resources sustainably and reduce water stress, water resources management, and the protection and restoration of water-related ecosystems. A review of the global status of progress towards meeting the multiple targets indicates that the world as a whole is not on track to achieve SDG 6, and many countries are even going backwards.

While progress is slow against all sub-goals and targets of SDG 6, there are two areas of particular concern. The first area of concerns is the universal access to safely managed drinking water services and safely managed sanitation services. While the number of people lacking safely managed services has decreased by significantly in recent years, 2 billion people still lacked access to safely managed drinking water services. Of this, 1.2 billion people could not obtain even basic services, 282 million did not have services when needed, 367 million relied on sources that do not protect against contamination, and 122 million were drinking surface water directly. Limited progress has been achieved in enhancing access to sanitation, with only 2.4 billion people having access to safely managed sanitation services in 2020. Only eight countries had reached universal coverage to safely managed sanitation services, all of which are high-income countries. While 1.9 billion people lacked access to even basic sanitation services, 494 million people continued to practice open defecation. If the current trends persist, only 81% and 67% of the world's population will have access to safely managed water and sanitation services, respectively, by 2030. This means that 1.6 billion people and 2.8 billion people will be left behind, without safely managed water and sanitation services, respectively. Achieving these targets by 2030 will require a fourfold increase in the current rate of progress.

3.3 Inequality in access to water and sanitation

There exists significant inequality or inequities in access to water and sanitation that manifest themselves at different levels. The first level of disparity is between regions, with Sub-Saharan Africa (SSA) falling furthest behind. Coverage of safely managed drinking water services stood at 96% in Europe and Northern America in contrast to 30% in SSA. Similarly, 78% of the population in Australia and New Zealand had access to safely managed sanitation services in contrast to 34% in Latin America and the Caribbean, and 21% in SSA (WHO and UNICEF, 2021). In fact, the number of people lacking basic sanitation services in SSA increased between 2000 and 2020, as the population grew by 73% over the same time period, although 290 million gained access to at least basic sanitation services during this time. Nearly half of those without access to basic drinking water services in 2020 lived in the Least Developed Countries (LDCs). The disparity can also be seen in the quality of facilities and services across regions. Almost the entire population in Europe and North America has generally contaminant-free water available on premises and on demand. Conversely, only 36% of the population in Oceania had access to water when needed, while only 36% of Sub-Saharan Africa had access to contaminant-free water. Countries characterized as LDCs, Small Island Developing States, or Landlocked Developing Countries and countries in Sub-Saharan Africa and Central and Southern Asia have a greater share of population using on-site sanitation facilities. For LDCs, where the highest priority is to simultaneously close the large gaps in access to water and energy, ensure food security, and promote growth in other economic sectors, the nexus of water and other systems could lead to constraints in ensuring water for all when needed. Low-carbon energy sources can support both energy and water security goals (through a reduction in water demand and wastewater) as long as the low-carbon fuel comes from a less water intensive alternative to higher carbon fuels. It is worth noting that some future energy options which may be key to some countries' goals under the Paris Agreement, such as carbon capture and storage, could worsen water stress in regions already experiencing water scarcity. Increased demand for water may have to be met by using coastal waters or non-traditional sources, such as treated wastewater, which in turn could use more energy.

Second, coverage also varies widely within regions. For example, in Eastern and South-Eastern Asia, coverage of safely managed drinking water services stood at 99% in Malaysia, while that in Lao People's Democratic Republic and Cambodia was 18% and 28%, respectively. Furthermore, while northern American countries enjoy access to clean water, countries in Latin America such as Ecuador, still has a large proportion of households who does not live in a hygienic environment and, for example, does not have accessible drinking water, cannot dispose of their excrement adequately, or do not have handwashing facilities. Similarly, in sub-Saharan Africa, national coverage ranged from 94% in Reunion to a mere 6% in Chad and nearly half of those without access to basic drinking water services in 2020 lived in the least developed countries.

3.4 Science, technology, and innovation for ensuring safe water and sanitation for all

Some of the oldest forms of infrastructure in recorded history relate to the harnessing of water, with the supposedly oldest wooden water well from the neolithic period dated from the age of the wood to 7200 years old. Irrigation systems have been dated around the same period, for instance those of the Jordan Valley which date from 6000BC. These early successes resulted in local water security, enabling the development of agriculture and human settlement that has become the basis of human civilization as we know it.

Science, Technology and Innovation (STI) is pronounced in every part of the water value chain, from abstraction of surface or groundwater to treatment for safe use, to effective reticulation to end-users, to return flows of polluted waters, to wastewater treatment back to stream, and all over again. The different parts of this value chain correspond to the different targets in SDG 6. In general, the global water community has not been a sufficient beneficiary of the knowledge of STI.

The contribution of the STI enterprise to achieving SDG 6 including universal access to safe water and sanitation can be divided into three realms. The first is analytical science that focuses on research and knowledge augmentation. The second is developing solutions through technological invention and innovations to attend to the problems and improve the ways in which solutions are rolled out. The third is the embedding and upscaling of solutions in the water value chain so that these solutions become the dominant and improved way in which water and sanitation challenges are managed. Recognizing the wide spectrum of innovation is crucial while at the same time realizing that innovation is primarily technological. Though technological innovation is an invaluable contributor to progress in water and sanitation and all other SDG6 sub-goals, alone it is insufficient. Where very good technological solutions exist, the achievement of real and lasting impact requires a wider spectrum of innovation: innovation in process, in policy and governance, and in social focus and outcomes.

Process innovations are critical to ensure optimization in both supply processes in operations as well as critical inventions in water demand management as a key tool for water security. Social innovation recognizes that modern water management has an acute appreciation that water management is about people and operates in specific social and cultural environments. Innovations in how to facilitate co-designed solutions and are jointly owned with communities and have a tacit appreciation of traditional and cultural knowledge have a better opportunity for sustainable solutions to water security. Policy and governance innovation is characterized by flexibility, data-driven decisions, and a willingness to adopt and help foster the implementation of proven innovations. It is often key to enabling new solutions to be introduced more rapidly and sustainably. The risk mitigation impact of good innovative policy and governance cannot be underestimated.

In many cases, simple and well-established solutions in water management can be used to address primary access to clean water and sanitation such as delivering drink water solutions to the populations. However, other aspects of management of water and sanitation may require new and emerging technologies. In this part, frontier technologies like drone, artificial intelligence, big data, internet of things, digital twinning, and space application, among other technologies may be the key to achieving SDG 6.

4.0 Science, technology and innovation for sustainable urban development

4.1 Critical role of Science, Technology and Innovation for Sustainable urban development

Science, technology and innovation has been at the forefront in mitigating the sustainability challenges facing urban sociotechnical systems in the aftermath of COVID-19 pandemic. Such deployment of STI has significantly enhanced urban sustainability in relation to energy, circularity, water, mobility, economic prosperity, housing, gender-related empowerment and equality, urban planning, safety and security and protection from natural disasters.

Recent times have witnessed accelerating technological change in renewable energy, artificial intelligence, machine learning and big data have opened new possibilities for addressing urban problems innovatively, at a lower cost and more sustainably. The international landscape in which science, technology and innovation and urban development policies interact has also changed since 2013, with the adoption of the following: Sendai Framework for Disaster Risk Reduction 2015–2030; Addis Ababa Action Agenda of the Third International Conference on Financing for Development; 2030 Agenda for Sustainable Development, in particular Sustainable Development Goal 11; Paris Agreement under the United Nations Framework Convention on Climate Change; and New Urban Agenda adopted by the United Nations Conference on Housing and Sustainable Urban Development.

4.2 Energy

17. Urban sociotechnical systems for energy production and distribution are highly dependent on fossil fuels. A transition to low carbon and sustainable renewable sources is urgently needed, especially considering the steep increase in urban energy demand that an expanding population will progressively lead to. The use of renewable sources has gained momentum in the last two decades. However, the share of such sources has remained limited in comparison with that of fossil fuels. This gap has triggered significant investments in research and development activities, which have resulted in notable technological and non-technological advancements. Examples of science, technology and innovation solutions to challenges related to unsustainable urban energy systems include solar, wind, hydropower, biomass and geothermal energy systems that leverage available natural resources and local climate conditions to produce green energy, green hydrogen technology and energy efficient buildings. Most such solutions have already been embedded in urban settings and others serve urban areas by providing clean energy produced beyond administrative boundaries. Offsite renewable energy production, however, may be undermined by potential market and policy-related barriers, and the diffusion of green energy production models may benefit urban areas at the expense of rural territories. For example, wind farms can negatively impact the welfare of rural populations. It is important for policymakers to devise mechanisms to arbitrate such potential conflicts between public policy goals and to ensure sustainable outcomes that do not unfairly externalize the costs of urban energy transitions to rural populations.

Opportunities exist in the form of Solar photovoltaic systems to produce urban energy such as in buildings and waste management systems. There is also need for energy efficiency in the construction sector. Mandatory standards are a powerful policy instrument with which to stimulate demand for innovation. Many developing and developed countries have introduced regulatory systems requiring new construction and renovations to comply with minimum energy performance standards, such as energy rating systems, performance certification schemes, building and construction codes and standards, solar thermal ordinances and design for sustainability approaches. Such solutions help firmly embed sustainable development principles in the building and construction sector, while providing supply chain actors with regulatory frameworks that include local, national and international sustainability-related expectations

4.3 Circularity

20. Addressing production and consumption patterns has become a priority in many urban regions because they place a significant strain on the world's limited natural resources. Science, technology and innovation solutions in this area focus on decreasing material footprints per capita, preventing excessive waste production and increasing the rate of

recycling and reuse of different types of waste. For example, in Thailand, with a view to evenly distributing the benefits of prosperity to the wider community, a bio-circular-green economy model has been adopted that integrates 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, ranging from food and agriculture, health and medicine and bioenergy, biomaterials and biochemicals to tourism and the creative economy.

4.4 Water

Improving water use efficiency, demand management and leakage control is one of the most urgent actions needed in urban contexts. Smart technologies can provide the necessary support. For example, in India, a smart metering and automated leakage prevention system has been installed across 40,000 households, helping to save, on average, approximately 35 per cent of water consumption.35 Digital solutions for water protection can also increase the efficiency and effectiveness of water treatment, enabling real-time water monitoring and the more rapid detection of possible pollutants.

4.5 Mobility

Congestion and air pollution are some of most significant mobility-related problems in urban areas globally. Science, technology and innovation solutions to such urban sustainability challenges can be grouped into three main categories, namely, low-emission vehicles; policies, regulations and financial schemes to incentivize the use of more sustainable transport solutions; and intelligent transportation systems. The electrification of urban transportation systems is growing in both developed and developing countries as a result of more favourable policy settings, financial incentives and continuous research and development efforts that increase vehicle performance while reducing overall costs.

4.6 Economic prosperity and decent jobs

Implementing science, technology and innovation solutions could help policymakers foster entrepreneurship, promote economic prosperity and support financial stability among urban residents. During the pandemic, such solutions have become imperatives for the smart, sustainable and people-centred recovery of urban economies. To this end, countries have established dedicated urban zones for the development of science, technology and innovation. Several countries have established dedicated zones to nurture the sustainable development of science, technology and innovation, which promote job creation and the advancing of industrialization in urban areas. Such dedicated spaces support local urban innovation ecosystems, improving the ease of doing business, providing access to finance and tax support and creating demand for new job profiles. Examples of this approach are the technological hub in the Dominican Republic, science and technology parks in Kenya, innovation zones in Latvia, hubs of innovation and entrepreneurship in Portugal, high-technology parks in the Russian Federation and technology development zones in Turkey.41 By encouraging investment in high technology and promoting innovation and entrepreneurship, usually through government support, including tax incentives, such dedicated zones create job opportunities and contribute to the development of cities.

4.7 Housing

The development of more affordable and quality housing solutions is highly dependent on science, technology and innovation efforts. Many countries have placed cross-sectoral partnerships and industrial alliances for research and development at the centre of national development agendas for the housing construction sector, alongside the establishment of international standards to facilitate collaboration. Countries are now adopting digitalization of operations and manufacturing processes to support sustainable development in the housing construction sector. The wider use of digital fabrication techniques relying on information technology-controlled production environments can help improve efficiency while increasing production rates. For example, in China, a 57-floor skyscraper was built in 19 days using digital fabrication technologies and offsite manufacturing techniques; the use of traditional building techniques would have required more than one year of onsite construction. Additive manufacturing technologies can also be used in building new houses by deploying printed homes. Through the use of digital twin technology, virtual models can be created to predict the functioning of an object. This insight can be used to inform decision-making processes in the housing construction sector.51 Engineers and designers across manufacturing industries are increasingly using this technology to experiment with different design solutions and civil engineers use it as a supporting tool in the design, construction and monitoring processes of transport infrastructure assets.52 In addition, in housing construction, digital twin technology allows for the collection of information during the entire life cycle of a building and can help improve maintenance operations while facilitating data-sharing operations.

4.8 Gender-related empowerment and equality

Sustainable and inclusive urbanization cannot be realized without the introduction of safeguards against existing gender gaps, biases and discrimination. Science, technology and innovation solutions in this area range from new digital tools to non-technological interventions that support awareness-raising activities, community mobilization actions, educational programmes, legal and policy-related reforms and changes in institutional settings.

4.9 Urban planning

To ensure that central urban areas and peri-urban interfaces provide all residents with equal access to urban services, facilities and opportunities, local authorities and urban planners can use different science, technology and innovation solutions. Their adoption leads to a more detailed understanding of sustainable development issues and more efficient and inclusive decision-making processes. Such technologies help leverage collective intelligence and create the open, inclusive and highly collaborative environments required to ensure that urban planning processes take control of peri-urbanization processes and make urban spaces accessible to all people.

Studies of peri-urban planning and management have led to new approaches that respond to the specific needs of peri-urban interfaces. For example, in New Zealand, an innovative participatory process called spatial group model building has been piloted, which helps combine the expectations and knowledge of a wide range of actors into peri-urban planning processes by inviting them to co-design a group model building that connects the flows, processes and collaborative relationships among actors within a complex system. The participatory process is supported by geographic information system technology, which helps stakeholders visualize the physical space and connect the information on the building on digital maps.57 In Zambia, a study used the spatial group model building framework to investigate how East Coast Fever, a disease of cattle and buffalo, oscillated over time and to identify context-specific interventions that could mitigate the impact on the local economy.58 Spatial group model building has also been applied in Jashore District, Bangladesh; the state of Bihar, India; and Tanintharyi Region, Myanmar. Different digital support tools are currently available to allow local authorities, urban planners and other

4.10 Safety and security

Efforts are being made worldwide to sustain urban safety and security, primarily based on the use of innovative policy interventions and the increasing availability and performance of technological solutions. For example, in Doha, the local government, in collaboration with the United Nations Office on Drugs and Crime and its Line Up, Live Up initiative, aims to break the chain of violence by inducing behavioural change in at-risk youth by promoting sports as a means to learn tolerance and respect and to develop positive behaviours that could help youth avoid criminal activity and violence. Further, technologies for the spatial identification of crime hotspots have been implemented in cities worldwide. Crime mapping through geographic information system analysis, for example, is an effective measure that local police forces can adopt in urban areas to develop timelines and map locations of crime events. For example, in London, the police force used crime mapping with randomized controlled trial designs to examine the effects of increased visible patrols at bus stops; crime mapping can help the police predict crime patterns and reduce victim-generated calls for emergency and bus driver incident reports. In Mexico, maps are created by local authorities to identify areas prone to violence against women. In South Africa, researchers at the University of Pretoria have showcased the usefulness of crime mapping by developing a robbery risk model for the city of Tshwane, based on geospatial analysis in which commuter nodes and urban public facilities form points of interest.65

4.11 Protection from natural disasters

48. Science, technology and innovation solutions contribute to protecting urban areas and populations from natural disasters by empowering and giving a voice to people, including the most vulnerable; extending access to education services; making possible the monitoring of environmental risks; connecting people; and enabling the development of early warning systems.67 Data analytics capability is critical in urban regions facing natural disasters. To develop this capability, many local and national governments are increasing their efforts towards building integrated data management systems that pool critical information on urban infrastructure assets. For example, cities in Latin America and the Caribbean, following a series of natural disasters, have invested in developing the capacity to build a data management platform for supporting disaster management, by conducting activities that help connect heterogeneous data on critical infrastructures, and this integration process is already helping local governments model risks related to infrastructure in the areas of mobility and transportation.

4.12 Promoting Digital Economy

The digital economy is increasingly becoming a key driver in the global economy. In 2016, it accounted for 15.5% of the global Gross Domestic Product (GDP) and was projected to increase to 25% by 2026. Kenya is amongst the few countries in Africa that are taking an early lead to tap the benefits of digital technologies for economic growth. This is demonstrated by the steps taken by the government to put in place various policy and legal instruments and infrastructure to drive the digital economy. As a result, while Africa expects the digital economy to contribute about 5.2% of its GDP by 2025, Kenya's digital economy is expected to generate 9.24% of the total GDP by 2025. This, amongst other factors, demonstrates the importance of the digital economy to Kenya's economic prospects and transformation. Therefore, interventions that can contribute to further strengthening the digital economy in Kenya, are desirable. One such intervention is talent cultivation. The digital economy requires new sets of skills and knowledge, which many countries lack. It is projected that by 2030, over 230 million new jobs will be created in Sub-Saharan Africa which will require ICT skills, and that an estimated $130 billion investment opportunity lies in digital skills cultivation in Africa. A labour market analysis from the International Finance Corporation (IFC) and the World Bank showed that by 2030, 50-55% of jobs in Kenya will depend on digital skills, in comparison to 35-45% in Nigeria, one of Africa's largest economies1. These call for concerted efforts for talent cultivation in ICT to develop the required human capital with skills and competencies to help drive and sustain the digital economy of Kenya.

ICT deployment using, adopting, and adapting frontier technologies requires sufficient ICT infrastructure, especially since AI, IoT, big data, and blockchain are internet-based technologies. Two aspects of ICT infrastructure need to be considered: adequacy to ensure that everyone has access and that no one is left behind, and the quality of infrastructure that allows for more advanced and efficient use. For these purposes, internet users as a percentage of the population capture the adequacy, while the mean download speed measures the quality of internet connection.

5. Conclusions and Recommendations

It is observed that there is an urgent need to embed Science, Technology and Innovation (STI) into concepts of fair globalization, implying that the needs of developing countries receive adequate attention in international agenda and priority setting and can benefit adequately from knowledge and benefit sharing. The digital economy is increasingly becoming a key driver in the global economy, hence the need for strategic investment in ICT.

The North-South divide in innovation performance is very pronounced, both regarding input and output indicators to the innovation systems. The possibilities for developing countries to catchup with industrialized countries are hindered by low levels of technical and financial resources for a broad-based strategy of catching up on STI. This implies that many developing countries will need strong support from developed countries in identifying and implementing innovations to tackle global challenges. This happens at a time when impacts of climate change are also hitting many developing countries, which would need scaling up research to understand the impact chains related to global warming and science and technology to develop mitigation options and take advantage of green windows of opportunities. This is more urgent than ever in times of worsening climate change and its impacts on the developing world, e.g., exposure to natural disasters and deteriorated food security. Another element of fair globalization has to be that developing countries are granted all policy space required to take advantage of opening green windows of opportunities as a basis for sustainable development.

Water and sanitation are basic and essential human needs, hence access to water and sanitation is a human right. The SDG6 has taken a broader and integrated approach in addressing the issue of water and sanitation, going beyond simple access to these services, with a view to ensuring the sustainability of water supply and good sanitation services.

It is recommended that countries; Develop and expand national policies and strategies; Establish a national mechanism for coordination; Promote green technology diffusion in SMEs; Cultivate and empower local innovation ecosystems; Develop close partnership with local actors on water and sanitation; Transform infrastructure and service delivery for gender equality; Design sustainable and climate-friendly water and sanitation systems; Revamp data infrastructure in water and sanitation; Campaign for the use of effective low-tech tools for water and sanitation; Introduce new and more equitable financing mechanism; Boost scale-up of good practices; Promote knowledge transfer, capacity building, technology transfer , technology upgrading; and Strengthen international network and collaboration.