Global Sustainable Development Report

Perspectives of scientists on technology and the SDGs

Technology and the SDGs

Scientists see technology as a major factor that can help to meet the Sustainable Development Goals. Technology can help build on synergies among the goals, realize possible multiple benefits, and avoid barriers and conflicts. Against this background, the Global Sustainable Development Report 2016 presents a range of perspectives of 158 scientists - representing 43 sustainability science disciplines and all world regions - on the most promising actions or policy elements for optimal leveraging of technology for the SDGs, as well as on the most crucial emerging technologies until 2030.

The 2030 Agenda recognizes the importance of technology for the achievement of the SDGs. Technology is not only captured in SDG17 as a key "means of implementation". Among the 169 SDG targets, 14 targets explicitly refer to "technology" and another 34 targets relate to issues that are most often largely discussed in technology terms. These technology-related targets can be categorized under three overall targets: (a) significant overall technology performance improvement; (b) universal access to sustainable technology; and (c) global effective innovation system for sustainable development. While the creators of the SDGs overwhelmingly focused on the objective to "leave no-one behind" in all its dimensions, when it came to technology, they included a significant number of overall technology performance targets. This is very much in line with scientific findings that point to a need for making simultaneous progress in equity, overall technology performance and institutions, as well as in both radical and incremental technology change.

Scientists' policy proposals for leveraging technology for the SDGs

Contributing scientists provided a wide range of proposals for what they consider the most promising actions or policy elements for optimal leveraging of technology for the SDGs and 'leaving no-one behind'.

Theme	*Selected policy and action proposals by contributing scientists for leveraging technology for the SDGs*
Strengthening national systems of innovation to accelerate technology progress	• Systematically strengthen national systems of innovation, especially in developing countries. • Incremental and radical technology and infrastructure performance improvements – all are needed. • Barriers to technology deployment and diffusion in developing countries to be removed and R&D investments to be increased. • Coherent and comprehensive techno-economic policies are needed. • Science, technology, and innovation (STI) literacy need to be strengthened in every country to create knowledge-based, innovative societies that utilize scientific evidence to help inform policy. • Learning across spheres of practice and implementing lessons from existing technology-related initiatives and from "experiments" of new SDG-related technologies in specific communities.
Plans, roadmaps and integrated assessment	• National and international action plans and technology roadmaps for achieving the SDGs individually and together. • Science roadmaps, technology roadmaps and R&D roadmaps to agree on priority actions of the science and engineering communities. • Technology investments need to be significantly increased. • Share information and advice among countries on policies, actions, and partnerships. • Communication, education and public awareness raising are essential, especially among consumers. • Systems thinking and technologies for a circular economy. • Integrated assessment models can be useful to design sustainable development policies. • Countries to explore their own desired paths of economic diversification based on identification of promising technological trajectories and new industries. Industrial policies.
Putting technology at the service of inclusion	• Access to affordable, modern technology for everyone, especially in developing countries. • Inclusive innovation policies to promote equity. • Technology assessment and foresight to understand potential implications of new technologies and guide policy. • Ecosystem approach to policy, in order to address technology gaps continually arising with new technologies. • Taking into account the interests of underserved populations throughout the innovation process. • Promote access to and use of assistive technology for people with disabilities. • On-the-ground solutions and technological innovations to be considered a core component of livelihood strategies. • Leverage the social technology of sharing in urban slums. • Intervention research drawing on cognitive science, psychology, behavioural economics, and anthropology. • Explicitly consider informal cultural norms and the nexus to formal rules when assessing technology needs/gaps.
Building institutions that support sustainable technology progress	• Institutions need to be reformed to re-orient innovation systems towards sustainable development. • Support for R&D and incentives for deployment of cheaper technologies with systemic benefits, including off-grid electricity systems, e-mobility and novel antimicrobial medicines. • Promote urban innovation units, living labs, open science, and science parks, to harness localised, inclusive innovations. • Re-defining megacities' functions through legislation and balanced distribution of public resources. • Institutions to promote development of low cost local technology solutions based on community knowledge. • Better data need to be collected, openly shared and analysed. • Partnerships at the city and national levels could bring together and share disaggregated data. • New tools and scientific innovations for data collection and analysis. Big data to monitor and promote the SDGs.

Clusters	*Crucial emerging technology for the SDGs until 2030*	*Opportunities in all SDG areas*	*Potential threats*
Bio-tech	Biotechnology, genomics, and proteomics; gene-editing technologies and custom-designed DNA sequence; genetically modified organisms (GMO); stem cells and human engineering; bio-catalysis; synthetic biology; sustainable agriculture tech;	Food crops, human health, pharmaceuticals, materials, environment, fuels.	Military use; irreversible changes to health and environment.
Digital-tech	Big Data technologies; Internet of Things; 5G mobile phones; 3-D printing and manufacturing; Cloud computing platforms; open data technology; free and open-source; Massive open online courses; micro-simulation; E-distribution; systems combining radio, mobile phone, satellite, GIS, and remote sensing data; data sharing technologies, including citizen science-enabling technologies; social media technologies; mobile Apps to promote public engagement and behavioural change; pre-paid system of electricity use and automatic meter reading; digital monitoring technologies; digital security technology.	Development, employment, manufacturing, agriculture, health, cities, finance, absolute "decoupling", governance, participation, education, citizen science, environmental monitoring, resource efficiency, global data sharing, social networking and collaboration.	Unequal benefits, job losses, skills gaps, social impacts, poor people priced out; global value chain disruption; concerns about privacy, freedom and development; data fraud, theft, cyber-attacks.
Nano-tech	Nano-imprint lithography; nano technology applications for decentralized water and wastewater treatment, desalination, and solar energy (nanomaterial solar cells); promising organic and inorganic nanomaterials, e.g., graphene, carbon nanotubes, carbon nano-dots and conducting polymers graphene, perovskites, Iron, cobalt, and nickel nanoparticles, and many others;	Energy, water, chemical, electronics, medical and pharmaceutical industries; high efficiencies; resources saving; CO_2 mitigation.	Human health (toxicity), environmental impact (nanowaste)
Neuro-tech	Digital automation, including autonomous vehicles (driverless cars and drones); IBM Watson; e-discovery platforms for legal practice; personalization algorithms; artificial intelligence; speech recognition; robotics; smart technologies; cognitive computing; computational human brain models; meso-science powered virtual reality.	Health, safety, security (e.g., electricity theft), higher efficiency, resource saving, new types of jobs, manufacturing, education.	Unequal benefits, de-skilling, job losses and polarization, widening technology gaps, military use, conflicts.
Green-tech	**Circular economy:** technologies for remanufacturing, technologies for product life-cycle extension such as re-use and refurbishment, and technologies for recycling; multifunctional infrastructures; technologies for service integration of centralized and decentralized systems. **Energy:** modern cookstoves with emissions comparable to those of LPG stove; deployment of off-grid electricity systems (and perhaps direct current); mini-grids based on intermittent renewables with storage; advances in battery technology; heat pumps for space heating, heat and power storage and electric mobility (in interaction with off-grid electricity; smart grids; natural gas technologies; new ways of electrification; desalination (reverse osmosis); small and medium sized nuclear reactors; biofuel supply chains; solar photovoltaic, wind and micro-hydro technologies; salinity gradient power technology; water saving cooling technology; LED lamps; advanced metering; low energy and CO_2 emission technology. **Transport:** integrated public transport infrastructure, electric vehicles (e-car and e-bike), hydrogen-fueled vehicles and supply infrastructures. **Water:** mobile water treatment technology, waste water technology, advanced metering infrastructure. **Buildings:** sustainable building technology, passive housing. **Agriculture:** Sustainable agriculture technology; Innovations of bio-based products and processing, low input processing and storage technologies; horticulture techniques; irrigation technologies; bio-organometallics which increase the efficiency of biomimetic analogues of nitrogenase. **Other:** marine vibroseis, artificial photosynthesis.	Environment, climate, biodiversity, sustainable production and consumption, renewable energy, materials and resources; clean air and water; energy, water and food security; development, employment; health; equality.	New inequalities, job losses; concerns about privacy, freedom and development.
Other	Assistive technologies for people with disabilities; alternative social technologies; fabrication laboratories; radical medical innovation; geo-engineering technologies (e.g. for iron fertilization of oceans); new mining/extraction technologies (e.g., shale gas, in oceans, polar, glacier zones); deep sea mining technologies;	Inclusion, development, health, environment, climate change mitigation, resource availability.	Pollution, inequalities, conflict.

Sources: Results of an online survey among scientists and experts conducted in April 2016 and GSDR science-policy briefs.

Their proposals typically encompassed several themes and types of actions - not just one or two - and reached far beyond their specific disciplines. They suggested making simultaneous progress on equity issues (especially technology access), on overall technology system performance, and on supporting institutional change. A two pronged approach was suggested that supports both research and development at the technology frontier and promotes diffusion/adaptation of existing technologies in developing countries and among marginalized groups in all countries.

Crucial emerging technologies for the SDGs

A number of science-related processes routinely identify emerging technologies and elements of technology solutions for achieving the SDGs - academies of sciences, individual academics, NGOs, the private sector and the UN system. Mapping these technologies to the SDGs could be a productive way to engage the science and engineering community more broadly. In the responses to the survey conducted for GSDR 2016, many scientists also pointed out specific opportunities and threats related to the identified technologies. The table above provides an overview of perspectives. Identified technologies fall into the bio-tech, digital-tech, nano-tech, neuro-tech and green-tech clusters.

Little information appears to exist on the level of performance and deployment of these technologies that would need to be achieved by 2030. While some quantifications exist in this regard, further collaboration on SDG scenarios and roadmaps that explicitly incorporate technology will be essential. Long-term technology roadmaps can support business development and policy planning.

The full report and background documents are available at: https://sustainabledevelopment.un.org/globalsdreport