

**INTERSESSIONAL PANEL OF THE UNITED NATIONS COMMISSION
ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT (CSTD)**

**Geneva, Switzerland
21-22 October 2024**

Contribution by Türkiye

to the CSTD 2024-2025 priority theme on “Technology foresight and technology
assessment for sustainable development”

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PRIORITY THEME 2: Technology foresight and technology assessment for sustainable development

United Nations Commission on Science and Technology for Development (CSTD)

Dear CSTD Member,

The [27th CSTD annual session](#) selected “Technology foresight and technology assessment for sustainable development”, as one of the priority themes for its 28th session (2024-2025) period).

Along with unprecedented opportunities, rapid technological developments present multifaceted challenges and risks, socio-economic disruptions and environmental impacts, among others. STI foresight (ForSTI)¹ and technology assessment (TA)² are useful tools for identifying and understanding key emerging trends and the risks and opportunities from the creation and adoption of new technologies, improving the quality of decision-making by making it better informed, more evidence-based and inclusive, promoting inclusive discussion, and identifying strategic priorities for future STI policy at the national level, and thereby enable more effective adaptation to technological and other systemically important future changes. STI foresight is a systematic process aimed at envisaging the future and strategically making decisions on STI policy and the use policy actions in the present to arrive at a preferred future.

Technology assessment is an interdisciplinary process for assessing opportunities and risks of new technologies, informing policymakers, inducing public dialogues and debates, and helping frame supportive policies and instruments. Therefore, they are policy tools that are particularly relevant to ensuring that policymakers can identify STI policy actions and implement more inclusive policy processes that move towards leaving no one behind, which is closely aligned with the theme under consideration for ECOSOC 2025 (“Advancing sustainable and inclusive solutions for leaving no one behind”).

The annual resolutions negotiated at the CSTD have consistently underscored the importance of technology foresight and TA exercises and have encouraged all stakeholders to conduct inclusive national, regional and international and foresight exercises on existing, new and emerging technologies to help to evaluate their development potential and mitigate possible negative effects and risks. By integrating these processes into strategic planning and innovation policymaking, countries could navigate better the complexities of technological changes while maximizing its benefits for national development.

Under this theme, the Commission will consider issues such as the methodology for conducting ForSTI and TA, good practices and challenges in conducting these exercises, and the effective integration of the results from these exercises into the design and implementation of STI policies that will drive progress towards achieving the SDGs. The Commission will also consider how international cooperation and the CSTD could play a role in this regard.

The CSTD secretariat is in the process of drafting an issues paper on the theme to be presented at the CSTD inter-sessional panel meeting to be held on 21 and 22 October 2024 in Geneva. In this context, we would like to solicit inputs from CSTD member States on this theme. We would be grateful if you could kindly answer the following questions based on your experience in your country or region. To facilitate your answering, we have made the questions be as specific as possible.

¹ Technology foresight is a term that can be usefully broadened to STI foresight to recognize that STI is broader than technology alone, and foresight for national policy related to technology can include STI more broadly defined. This remains narrower than “strategic foresight”, which can be applied to many areas of policy and diverse uses, and “futures”, which can include many future-oriented studies of a diverse nature.

² TA is not the same as technology needs assessment (TNA), which aims to identify technology needs for addressing climate change rather than the impacts of adopting a technology new to the country.

1. Has your country conducted ForSTI, TA or both? If yes, what were the reasons for undertaking ForSTI and TA?

Türkiye has been actively conducting Foresight Studies for Science, Technology, and Innovation (STI) as well as Technology Assessment (TA) practices. These activities are crucial for preparing strategic plans. Notable examples include Vision 2030 and Technology Prioritization studies, both under the auspices of the T.R. Presidential Office Science, Technology, and Innovation Policy Council, and the preparation of the 12th Development Plan.

The Science, Technology, and Innovation Policy Council (STIPC) is one of the highest-level advisory policy councils affiliated with the President of Türkiye. It is the premier advisory body on STI policy developments and the monitoring of the national STI ecosystem. STIPC's primary responsibilities include formulating policies to encourage and support R&D activities, making recommendations on STI policy, identifying strategic technology areas, and preparing medium and long-term STI policies. Additionally, the council develops strategies for research infrastructures.

STIPC evaluates the entire STI ecosystem, considering economic, social, and national security goals. It conducts inter-governmental meetings, coordinates with other policy councils, and engages with stakeholders. The council also performs advanced analyses on the recommendations and actions approved by the President. One of its key policy reports, "Prioritized Technology Areas for Türkiye," uses both quantitative and qualitative analyses to identify high-impact, feasible technologies to focus R&D efforts.

The study prioritizes activities within the R&D and innovation ecosystem, emphasizing socio-economic benefits and societal value. A strategic approach was necessary to address improvement areas, involving comprehensive analyses to identify priority technology areas for R&D and innovation. These analyses considered international technological foresight studies, the focus areas of both developed and developing countries, and critical technology areas relevant to national needs and security, resulting in the evaluation of 22 technology areas.

These technology areas were analysed for their economic, societal, and national security impacts, as well as feasibility, including academic knowledge, private sector capability, research infrastructures, patent accumulation, skilled human resources, access to finance, and technological readiness. Data from various sources and expert opinions established indicators, and the Delphi method was used for qualitative analysis. This approach aims to guide the identification of improvement areas.

The Vision 2030 Technology Foresight study, conducted by STIPC with technical support from TÜBİTAK, aimed to identify strategic development areas and emerging technologies to maximize economic and social benefits over a 10-15 year period. A comprehensive horizon scan of global trends was performed, referencing 44 current foresight reports from international organizations like the EU, OECD, UN, NATO, and WEF, and consultancy firms such as Gartner, Ernst & Young, and KPMG. The study systematically explored long-term future trends in economics, technology, society, geopolitics, health, food, environment, energy, and natural resources, resulting in the "Major Global Trends Report." A technical framework for a Delphi survey to evaluate these trends' likelihood and impacts on the country was also established.

Foresight Studies and Technology Assessment are also integral in preparing Türkiye's Development Plans. Within the scope of the 12th Development Plan, long-term national STI policy targets are determined by specialized, issue-oriented commissions. The Specialized Commission on "Strengthening the R&D and Innovation Ecosystem," one of 60 such commissions for the 12th Development Plan, analysed the current national R&D and innovation ecosystem and developed policy actions to enhance its efficiency. This commission incorporated global trends and technology foresight activities to produce its inputs for the Development Plan.

2. If you have not conducted ForSTI or TA in the past, what were the reasons for this (lack of need or requests for it, lack of familiarity, lack of capacity, lack of funding etc.)? Would you be interested in pursuing either ForSTI or TA as a policy tool in the near future?
3. What agency (or agencies), if any, is responsible for ForSTI and/or TA?

Key actors in the governance of Türkiye's national STI ecosystem include the Science, Technology, and Innovation Policies Council of the Presidency of the Republic of Türkiye, the Presidency of Strategy and Budget, the Ministry of Industry and Technology, and the Scientific and Technological Research Council of Türkiye (TÜBİTAK), which is affiliated with the Ministry of Industry and Technology. Additionally, sectoral ministries in agriculture, energy, environment, climate change, health, and transportation, along with their affiliated agencies, also conduct Foresight Studies and Technology Assessment (ForSTI and TA) activities.

4. Who was responsible for implementing the ForSTI and/or TA undertaken - national government, sub-national levels of government (state/province or other levels), industry, universities, research institutes or civil society?

The Science, Technology, and Innovation Policy Council (STIPC) of the Presidency of the Republic of Türkiye is the highest-ranking advisory body on STI policy developments and the monitoring of the national STI ecosystem. Its major responsibilities include formulating policies to encourage and support R&D activities, making recommendations on STI policy, identifying strategic technology areas, preparing medium and long-term STI policies, and developing strategies for research infrastructures.

To evaluate the STI ecosystem comprehensively, the Council holds inter-governmental meetings, coordinates with other policy councils, and engages with stakeholders to address STI issues. STI priorities outlined in national policies and strategies are incorporated into TÜBİTAK's priority R&D topics. Project applications within these topics are given priority in TÜBİTAK's programs, both in academic and industrial R&D support, through additional points at the evaluation phase.

5. In which sectors and/or for what policy processes have ForSTI and TA been undertaken, or linked to? What SDGs have they related to?

The study titled "Prioritized Technology Areas for Türkiye" under the auspices of Science, Technology, and Innovation Policy Council (STIPC) include quantitative and qualitative analyses. These analyses determine high-impact and feasible technologies to focus Research, Development, and Innovation (RDI) efforts as part of the government's STI policy mix. The critical technologies which has been subject to analysis were advanced functional and energetic materials, motor technologies, biotechnological medicine, IoT, energy storage, robotics and mechatronics, AI, big data, cybersecurity, broadband technologies (5G and beyond), MEMS/NEMS, and agricultural biotechnology. The findings have also been integrated as key inputs for the "Critical Technologies" chapter of Türkiye's Twelfth National Development Plan.

For 2022 and beyond, six new technology roadmaps have been prepared under the auspices of STIPC, with coordinated technical support from the Ministry of Industry and Technology and TÜBİTAK. These roadmaps focus on AI, advanced materials, biotechnological pharmaceuticals, big data and cloud computing, motor technologies, and cybersecurity. They serve as crucial inputs for national strategies and future funding plans. These roadmaps are designed to create a multi-layered structure, outlining technological strategic objectives, critical products, and priority sectoral applications of these technologies and products.

These studies, carried out within the framework of ForST and TA in Türkiye, are related to various Sustainable Development Goals (SDGs). These are given below.

- Advanced Functional and Energetic Materials
 - SDG 7: Affordable and Clean Energy - Materials that enhance renewable energy technologies and energy efficiency.
 - SDG 9: Industry, Innovation, and Infrastructure - Advanced materials support industrial innovations.
- Engine Technologies
 - SDG 9: Industry, Innovation, and Infrastructure - Innovative engine technologies increase industrial efficiency.
 - SDG 13: Climate Action - More efficient engine technologies can reduce greenhouse gas emissions.
- Biotechnological Medicine
 - SDG 3: Good Health and Well-being - New biotechnological treatments and drugs improve public health.
- Internet of Things (IoT)
 - SDG 9: Industry, Innovation, and Infrastructure - IoT optimizes smart city and industrial processes.
 - SDG 11: Sustainable Cities and Communities - Smart city technologies support sustainable urban planning.
- Energy Storage
 - SDG 7: Affordable and Clean Energy - Energy storage solutions increase the use of renewable energy.
- Robotics and Mechatronics
 - SDG 8: Decent Work and Economic Growth - Robotics automation enhances production efficiency, supporting economic growth.
 - SDG 9: Industry, Innovation, and Infrastructure - Robotics and mechatronics contribute to industrial innovations.
- Artificial Intelligence (AI)
 - SDG 9: Industry, Innovation, and Infrastructure - AI technologies support industrial and infrastructural innovations.
 - SDG 16: Peace, Justice, and Strong Institutions - AI can enhance the efficiency and transparency of public services.
- Big Data
 - SDG 9: Industry, Innovation, and Infrastructure - Big data analytics improve industrial processes and support innovations.
 - SDG 17: Partnerships for the Goals - Big data can enhance the monitoring and evaluation of sustainable development goals.
- Cybersecurity
 - SDG 16: Peace, Justice, and Strong Institutions - Strong cybersecurity infrastructure is critical for secure and fair digital societies.
- Broadband Technologies (5G and beyond)
 - SDG 9: Industry, Innovation, and Infrastructure - Broadband technologies enhance digital connectivity and innovation
- MEMS/NEMS (Micro and Nano Electro-Mechanical Systems)
 - SDG 9: Industry, Innovation, and Infrastructure - These advanced technologies offer innovative solutions to the industry.

- Agricultural Biotechnology
 - SDG 2: Zero Hunger - Agricultural biotechnology can increase food security and agricultural productivity.

6. What specific methods (tools) and methodologies have been used for ForSTI and/or TA?

As part of the task of determining priority technology areas for Türkiye, assigned by the President via the Third 100-Day Action Plan to the Science, Technology, and Innovation Policies Council (STIPC), a comprehensive approach was employed utilizing various methods and methodologies. Both quantitative and qualitative analyses were conducted, incorporating data and expert opinions. The assessment focused on two main dimensions: impact and feasibility.

Impact analysis was divided into three sub-dimensions: economic impact, social benefit, and national security. Tools used in this process included bibliometric studies, technology readiness level (TRL) assessments, surveys for social impact, and expert prioritization for security impacts. Feasibility analysis covered sub-dimensions such as academic knowledge productivity, private sector competencies, research infrastructures, financial accessibility, patent analysis, and qualified human resources.

Senior experts from institutions like the Central Bank of the Republic of Türkiye, the Presidency of Defense Industries, and TÜBİTAK played significant roles in the technical and quantitative analyses. Additionally, the qualitative evaluation involved Delphi analyses, workshops, and consultation meetings with senior academicians, private sector representatives, and experts from public bodies and NGOs. Delphi surveys were crucial for achieving comprehensive technology forecasts and monitoring, ensuring high levels of stakeholder participation within the R&D and innovation ecosystem.

7. What challenges have you experienced in undertaking ForSTI and TA exercises? Does your country have any specific capacity needs to strengthen the conduct and use of ForSTI and TA?

For Türkiye, there is a need for extensive training and technical assistance in conducting thorough foresight studies and scenario-building exercises.

8. Have you conducted combined ForSTI and TA in a single exercise at any time? What were the benefits and challenges of combining ForSTI and TA? Do you see this as a useful and feasible approach?

No.

9. Are you involved in any international cooperation or partnerships for ForSTI and TA? Which ones and what are their benefits?

No.

10. What role(s) can international cooperation, and the CSTD, play in promoting ForSTI and TA?

Regional cooperation plays a crucial role in addressing global challenges and achieving Sustainable Development Goals (SDGs). Therefore, the Committee on Science and Technology for Development (CSTD) can promote regional collaboration in conducting Foresight Studies and Technology Assessment (ForSTI and TA) studies on global challenges and SDGs. These efforts may include workshops and the production of joint reports that reflect regional actions aimed at addressing global challenges and advancing SDGs.

11. What have been some important ForSTI and TA examples undertaken in your country, especially related to national policy (prioritization, design etc.)?

Foresight for STI and Technology Assessment studies, namely the Vision 2030 and Technology Prioritization studies, both under the auspices of the T.R. Presidential Office Science, Technology, and Innovation Policy Council, and preparatory analysis for the 12th Development Plan; has led to the give directionality to RDI supports and incentives.

12. Based on your experiences, how have ForSTI and TA improved STI decision making and the prioritization, design and implementation of STI policies?

Foresight Studies (ForSTI) and Technology Assessment (TA) have significantly enhanced decision-making in Science, Technology, and Innovation (STI), as well as the prioritization, design, and implementation of STI policies. By aligning STI priorities with national needs and capacities, we have developed more targeted and effective policies. These tools provide a structured approach to evaluating the potential economic, social, and security impacts of emerging technologies, enabling informed and strategic decision-making. This alignment ensures that our STI initiatives are not only innovative but also sustainable and inclusive, addressing the unique requirements of our country.

Please indicate contact person(s) and agencies responsible for projects/policies and international collaboration on ForSTI and TA in case we need clarification on the inputs.

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Please send your responses and any further inputs on the theme to the CSTD secretariat (stdev@unctad.org) by 24 **July 2024**. We look forward to receiving your valuable inputs.

Sincere regards,
CSTD secretariat