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Contribution by Türkiye

to the CSTD 2024-2025 priority theme on "Diversifying economies in a world of accelerated digitalization"

PRIORITY THEME 1: Diversifying economies in a world of accelerated digitalization

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

Dear CSTD Member,

The 27th CSTD annual session selected "Diversifying economies in a world of accelerated digitalization" as one of the priority themes for its 28th session (2024-25 period). This theme directly addresses SDG 9 "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" at the 2030 Agenda.

Although the contribution of science, technology and innovation (STI) to the achievement of other sustainable development goals (SDGs) is discussed in every session of the CSTD, its role in upgrading and diversifying industrial capabilities and the linkages with industrial policies have not been specifically addressed for several years in the Commission. Economic diversification, including through the upgrading of industrial capabilities, is an essential component of economic development and a key area of SDG 9, which aims at enhancing scientific research and accelerating technological upgrade of industries through innovation, particularly in developing countries.

Under this priority theme the Commission could discuss challenges and opportunities brought about the rise of new digital technologies, as Artificial Intelligence, for industrial and innovation policies aiming at increasing productive capacities and diversifying the industrial structure toward higher value productions to benefit all while preserving cultural identity, including indigenous knowledge. The accelerating pace at which frontier technologies emerge and develop makes policymakers struggle to navigate and design responsive policies. Under this theme, the Commission can examine the challenges and opportunities specific to countries at different level of development, and what can least developed countries do to face the disproportionate challenges they face; work to identify best practices and inform inclusive policies for innovation and economic diversification; discuss how to leverage international cooperation to guarantee that uneven technological capabilities will not worsen inequality.

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 in the second half of 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.

1. What are the specific challenges your economy is facing to develop or adapt frontier technologies and AI?

   Although this issue is not a situation seen throughout the country, when looking at the total export rate of high technology exports, it is seen that there is a lot of progress to be made. Although there are many people educated in the fields of engineering and informatics in Türkiye, there is a lack of skills that require special expertise in the field of advanced technology and artificial intelligence. This is a worldwide problem, and there is a shortage of qualified software developers, data scientists and artificial intelligence experts in Türkiye. The education provided at universities may not be fully compatible with rapid technological changes. Modern and dynamic curricula focusing on artificial intelligence and advanced technologies are a matter of debate. Although there are some preparations in this area, there is still a cautious approach. Because, in order to develop technology in the field of artificial intelligence, the target talent group must first be at a very good level in several fields such as mathematics, physics, neuroscience, computer science, data science and linguistics.

   The technological infrastructure must be strong for artificial intelligence and high technology studies. In particular, investments need to be strengthened in infrastructure elements such as high-speed internet, cloud computing, R&D laboratories and data centers required by advanced technologies and artificial intelligence applications.

   Although the technology-focused start-up ecosystem is developing, sufficient capital and investment support in this field is not yet mature. In order to encourage startups in a highly competitive field such as high technology, the investor ecosystem must lean towards this direction. The development of venture capital and investment culture is vital for the growth of

technology startups. Investment opportunities and resources in this field need to be increased in Türkiye.

Digital transformation of the industry is critical for the effective application of artificial intelligence and advanced technologies. However, most of the industrial enterprises in Türkiye still operate with traditional methods. The adaptation of these businesses to digitalization and new technologies should be accelerated.

In Türkiye, especially in traditional ways of doing business, there is a reluctance to take risks. R&D projects generally involve high risk and uncertainty. Businesses and investors generally prefer shorter-term and safer investments. Some businesses or holdings do not want to leave their comfort zone, even if they have the capital to spend in this area.

There is always a lack of awareness about the importance of innovation and R&D in businesses and society in general. The fact that R&D is not seen as a strategic value prevents the prioritization of such investments.

Businesses should show long-term patience towards the work of the executive and developer team working on R&D projects. Measures must be taken to ensure that qualified personnel leave that project. Because one of the most basic conditions of R&D studies is that they are sustainable. There should always be a very effective road map for the financial resources required for the investment to be allocated here.

2. Can you provide successful examples of AI and other frontier technologies uptake in your country?

Türkiye is committed to integrating advanced technologies to promote innovation and increase productivity in various sectors. Our strategic investments and supportive policies continue to spur the growth and application of artificial intelligence and other leading technologies. Türkiye is taking important steps in the adoption of artificial intelligence (AI) and other leading technologies. Here are some successful examples:

I. Defense Industry

The Data Hive Project was developed to collect, prepare, crowdsource and label data, and create and manage reliable labeled data sets. (Presidency of Defense Industries)

II. Health Sector

The "Turkish Brain Project" was initiated in order to help doctors and reduce their workload in our health system, where the number of MRI scans exceeds 15 million. Within the scope of this project, various analyzes on brain MRI images are carried out using artificial intelligence-based systems. As soon as the image comes from the MRI device, the artificial intelligence-based system automatically performs analyzes and sends the results to the relevant imaging system of the hospital. This artificial intelligence-supported system prioritizes the MRI images taken according to the analysis results and presents them to doctors for evaluation. Thus, this project was implemented in order to intervene more quickly in patients who may need urgent intervention and to reduce the possibility of various complications. (Presidential Digital Transformation Office, Gazi University)

III. Smart City Applications

In big cities such as Istanbul and Ankara, advanced technologies are used within the scope of smart city projects. Sensors and AI systems are being integrated in areas such as traffic management, energy efficiency, security and environmental monitoring.

Many metropolitan municipalities have made progress in terms of smart public transportation system, smart stops, smart lighting and central traffic operating system. On the other hand, the system of generating electricity in solid waste facilities is becoming increasingly widespread among metropolitan municipalities. Metropolitan municipalities are developing applications that

provide continuous service delivery in the sense of e-municipalism.Has your country put in place inclusive policies for innovation and economic diversification specifically tailored to diffusion of digital technologies and AI?

IV. Financial Technologies (Fintech)

AI in Banking: Türkiye's financial sector has made significant progress in digital transformation. Large banks use AI-based chatbots and data analytics solutions to provide better service to their customers. BKM (Interbank Card Center) is working to accelerate digital transformation in Türkiye's payment systems.

Blockchain: While many different scenarios are being worked on around the world within the scope of Blockchain technology, the first Blockchain project used in workflows between financial institutions in Türkiye was implemented by Borsa Istanbul. With the Blockchain project prepared by Borsa Istanbul information technologies team, the information in the customer database of Borsa Istanbul, Takas Istanbul and Central Registry Istanbul for electronic application was synchronized.

In the project prepared with the Know Your Customer (KYC) concept, adding new customer information to the specified database, changing existing information and document management will be carried out via the Blockchain network. Thus, possible errors in entering information into the database were prevented and a fast, reliable and transparent platform was created.

The technical infrastructure of the application, which uses Blockchain chain as security infrastructure, can perform a high number of transactions and can be used in other projects when necessary.

V. Educational Technologies (Edtech)

Distance education and digital learning solutions have gained great momentum during the pandemic period. In Türkiye, platforms such as Education Information Network (EBA) offer online education opportunities to millions of students. AI-based personalized learning and analysis systems are used to monitor and improve student performance.

VI. Industry and Production

Within the scope of Industry 4.0, the Turkish production sector has entered the digital transformation process. Automation, robotics and AI systems are widely used to increase the efficiency of production lines and improve quality control processes. Large automotive manufacturers such as Tofaş and Ford Otosan have factories equipped with advanced technology solutions.

VII. Agricultural Technologies (AgriTech)

- With the Flow Forecast and Basin Optimization Model (ATHOM) project, the State Hydraulic Works (DSI) will estimate the future flow to single and sequential water structures for the Seyhan Basin and accordingly prepare the water budgets of the storage facilities and operate them on an hourly, daily, monthly and annual basis. It was developed and made available as a model GIS-based WEB application. It is aimed to disseminate the ATHOM software for our other basins (Ceyhan, Kızılırmak, Yeşilırmak, Fırat and Dicle Basins). (Ministry of Agriculture and Forestry)

- Within the scope of the Sunn Beetle Forecast Warning System, it was developed in order to reduce losses by taking advantage of the historical relationships between the factors affecting the population size and biology of the insect, by analyzing the current development trend of the pest, and by predicting the changes that will occur in the future. Sunen prediction warning system machine learning models are in the category of models that we can describe as models that learn by looking at examples or models that learn with the help of a tutorial. To train these models, meteorological data measured in the past and data on the phenology of wheat were combined with data on the bio-ecology of sunn wheat on the dates

corresponding to these measurements. Measurement data are described as sample questions/sample conditions and correct answers/correct labels in the subject data. Sample questions and their answers are collectively called training data. After the training data was prepared and presented to the computer, machine learning algorithms were run, resulting in a model that learned to give correct answers to the questions asked. (Ministry of Agriculture and Forestry)

- The Basin Planning Program (DSI-HaPP) aims to accelerate decision-making mechanisms and achieve more accurate results in the planning and operation of water resources systems. DSI-HAPP, which is user-friendly and can be applied to every basin, numerically models a single or multi-purpose dam-reservoir or a system consisting of multiple reservoirs and offers solution suggestions for optimal sharing of the water entering the system among various uses. Interconnected reservoirs in the desired number and location and their associated hydroelectric energy, irrigation, drinking water, flood etc. The performance of a system consisting of facilities serving certain purposes can be analyzed and a strategy that ensures optimum operation of water uses for these purposes can be determined. The developed program quickly reaches the optimum solution by using modern Global Optimization Algorithms, Genetic Optimization and Particle Swarm Optimization. Future flows expected to occur as a result of climate change can also be calculated by using ARIMA, Artificial Neural Networks and Machine Learning methods for reservoir inflows in the system. The developed program has started to be used in DSI's planning studies. (Ministry of Agriculture and Forestry)

VIII. Sport:

Sports Ability Screening and Sports Orientation Program is a program in which sports screenings are carried out for 3rd grade primary school students throughout the country and some of their biometric data are collected and processed. As a result of the scans, it is aimed to determine the sports branch that the measured students are prone to and to direct them to the relevant branch with algorithms independent of personal interpretation. Based on this need, studies in the field of AI and machine learning have been initiated. (Ministry of Youth and Sports)

IX. Energy:

With the Artificial Intelligence-Based Natural Gas Demand Forecasting System, it is aimed to predict natural gas consumption with higher accuracy, independent of humans. (Ministry of Energy and Natural Resources, General Directorate of Pipelines and Petroleum Transportation Joint Stock Company)

X. Retail and E-commerce:

AI-Powered Platforms: Leading e-commerce companies in Türkiye, such as Trendyol and Hepsiburada, use AI to enhance customer experiences through personalized recommendations, efficient inventory management, and automated customer service.

Logistics and Delivery: Companies like Getir, an on-demand delivery service, utilize AI and data analytics to optimize delivery routes and times, ensuring faster and more efficient service.

3. Has your country put in place mechanisms to strengthen industrial capabilities through partnerships among different stakeholders (e.g., university-industry, or private-public)?

Türkiye has developed various policies and strategies to promote the spread of digital technologies and artificial intelligence (AI). These policies aim to achieve innovation and economic diversification. These policies and strategies accelerate Türkiye's digital transformation and increase economic diversity. The integration of AI and digital technologies enhances Türkiye's competitiveness, contributing to a stronger position in the global arena. Here are some of the key policies and initiatives in this regard:

I. Digital Türkiye (e-Government) Project

The Digital Türkiye project aims to digitize public services and ensure that citizens can easily access these services. Through this project:

- Public services are offered via online platforms.
- Bureaucratic processes are reduced and accelerated.
- Transparency and accessibility are increased.

II. National Artificial Intelligence Strategy

The National Artificial Intelligence Strategy was prepared by planning to cross sectors and research areas horizontally in the field of artificial intelligence, taking into account the need for human resources. Contributing to the establishment of an innovation-based economic order in our country by applying Artificial Intelligence in all areas of socio-economic life and increasing localization in the production of Artificial Intelligence technologies is one of the main goals of our National Technology Move. The National Artificial Intelligence Strategy (UYZS) reveals the measures that will put our country's work in the field of Artificial Intelligence on a common ground between 2021-2025 and the governance mechanism that will be established to implement these measures. UYZS's vision is determined as producing value on a global scale with an agile and sustainable AI ecosystem for a prosperous Türkiye. In order to realize this vision, UYZS has been designed around 6 strategic priorities, in line with national policies and needs and taking into account the AI strategy recommendations of international organizations.

III. Technology Development Zones and Technoparks

The following supports are provided to companies, incubation companies and entrepreneurs running projects in Technology Development Zones and R&D and Design Centers.

- Tax deductions, exceptions and exemptions.
- SSI premium employer share support.
- Salary support equal to the gross minimum wage for two years to businesses employing R&D personnel who graduate from the programs to be supported.
- VAT exemption for machinery and equipment purchased within the scope of projects.
- Up to 75% discounted rent support for incubation companies located in technoparks.
- PhD student employment support.
- Software developed by companies in technoparks is exempt from VAT.

One of the main activities of Technology Development Zones is to enable the development of innovative and technology-based companies in the incubation centers they contain and to support entrepreneurship. Thanks to the qualified services and the ecosystem created in these incubation centers, where entrepreneurial companies are provided with office services, equipment support, management support, access to financial resources, critical business and technical support services, entrepreneurs are enabled to go through their start-up and development stages more smoothly. In the early years of start-up companies, consultancy, mentoring, etc. are provided to transfer the knowledge and experience they need about business life and globalizing markets. By providing services, it is possible for them to hold on to the market and for successful entrepreneurs to be brought into our innovation ecosystem.

The majority of technology-based software companies and entrepreneur candidates in Türkiye are located in 89 technoparks spread over 60 cities. There are more than 10 thousand companies in technoparks, and more than 50% of them are companies operating in the software sector. There are 2,802 companies carrying out projects related to artificial intelligence in technoparks. 4,167 projects are carried out in this field and 49,027 personnel are employed in these companies.

Among the projects carried out by a total of 1,311 R&D centers operating within the scope of Law No. 5746, there are a total of 605 projects related to Artificial Intelligence, 324 completed and 281 ongoing. There are also 207 R&D centers operating in the field of computer and communication technologies and software. The number of personnel employed in the centers operating in these two sectors is 17,534. Among these centers, there are a total of 337 projects related to Artificial Intelligence, 183 completed and 154 ongoing.

IV. Mobility Vehicles and Technologies Roadmap

The "Mobility Vehicles and Technologies Road Map" was published by the Ministry of Industry and Technology in 2022 in order to direct the transformation of domestic and national products and technologies and to prioritize the work to be carried out. The Road Map is a comprehensive document that serves as a guide to respond to global transformations in the field of mobility from a holistic perspective and to ensure that Türkiye benefits from this process to the maximum extent. In the Road Map, 2022-2022 is included in the fields of electric, connected, autonomous and shared vehicles, rail transportation vehicles and systems, marine vehicles and port management, UAVs and flying cars, as well as human capital, entrepreneurship, technology-oriented support programs and effective participation in international legislation. There are 46 targets, 184 actions and 9 critical projects for 2030.

V. 2023 Industrial and Technology Strategy

The 2023 Industry and Technology Strategy has been prepared by the Ministry of Industry and Technology with the contributions of stakeholders for Türkiye, a pioneer in producing high technology and added value in the digitalizing world. 2023 Industry and Technology Strategy will be the road map to realize Türkiye's "National Technology Strong Industry" vision and will focus on "High Technology and Innovation", "Digital Transformation and Industrial Move", "Entrepreneurship", "Human Capital" and "Infrastructure". It consists of 5 main components. Preparations for the continuation of this completed strategy are continuing and the 2024 – 2030 Industrial and Technology Strategy will be published shortly.

VI. Digital Transformation Office

The Digital Transformation Office, operating under the Presidency, coordinates and directs Türkiye's digital transformation processes. Its main duties include:

- Strengthening the digital infrastructure.
- Increasing the digital capacity of the public and private sectors.
- Developing and disseminating digital skills.

VII. KOSGEB and TÜBİTAK Supports:

The Small and Medium Enterprises Development and Support Administration (KOSGEB) and the Scientific and Technological Research Council of Türkiye (TÜBİTAK) offer various financial supports to innovative projects and R&D activities. Examples of TÜBİTAK supports include 1711 - Artificial Intelligence Ecosystem Call and 1511 - TÜBİTAK Priority Areas Research Technology Development and Innovation P.D.P. (Technology-Focused Industry Move Programme). KOSGEB's R&D, P&D and Innovation Support Program, SME Digital Transformation Support Program and SME Development Support Program are also within this scope. These institutions make it easier for entrepreneurs and researchers to implement their projects.

VIII. Competence and Digital Transformation Center (Model Factory) Project

The Competence and Digital Transformation Center (Model Factory) Project was launched in 2015 to disseminate digital technologies on the basis of lean production in all SMEs, especially in the manufacturing industry.

Centers that have been providing applied training/consultancy services under the name of "Model Factory" in various countries of the world since the early 2000s (through various applications on a real production system) have been providing services to improve the practical skills of the workforce, to enable them to learn better in experimental environments, to develop new It responds to the need to create practical trainings to be offered to businesses and physical environments in which these trainings will be offered in order to provide skills to relevant parties quickly.

The centers provide training and consultancy services such as continuous improvement, lean production, digital transformation, etc. It aims to change the current mindset of businesses on

issues, use human, machine/equipment, raw materials, materials, time and energy resources in the most efficient way and increase their competitiveness in a short time.

For this purpose, in our country, Competence and Digital Transformation Centers-Model Factories are being established with the work initiated in 2015 under the coordination of the Ministry of Industry and Technology, and cooperation is being carried out with the Chambers of Industry and Commerce, Universities and Organized Industrial Zones of various provinces. Presidential Programs, the Twelfth Development Plan (2024-2028) and the Strategic Plan of the Ministry of Industry and Technology include targets for increasing the number of Model Factories. Up to the present; The installation process of Model Factories has been completed in the provinces of Ankara, Bursa, Konya, Kayseri, Gaziantep, Mersin, Adana, Izmir, Eskişehir and Samsun, and the installation work of new Model Factories continues in the provinces of Kocaeli, Denizli, Trabzon and Malatya.

The target audience of Model Factories, which provide services on lean transformation, digital transformation, quality and product development, consists of SMEs, manufacturing industry enterprises, sector employees, university students and academicians. The Ministry of Industry and Technology carries out many activities, especially supports, in order for SMEs to benefit from Model Factory services.

Model Factories provide services in the fields of awareness-raising seminars, experiential training, Learn-Return programs and the development of university-industry cooperation projects. The Model Factory installation process consists of construction works, purchase of machinery and equipment, and installation of the learning line in the workshops. After the learning line is established, the training curriculum is created. Digital transformation competencies are provided to the existing line and digital transformation training is provided through this line. In the educational production environment offered by the Model Factory, the training program is structured on a sample product without any commercial activity. Model Factories as a legal entity; It continues its activities as a joint stock company or economic enterprise with the contributions of local stakeholders such as chambers of industry and commerce, universities, and organized industrial zones. In principle, Model Factories, which have a non-profit structure, offer their services for a certain fee and are managed by a structure in which public, private sector organizations, universities and non-governmental organizations are represented.

Applied trainings offered according to the results of the Learn-Transform Program that Model Factories are completing are extremely effective on the performance of businesses. Some of the gains achieved by companies receiving Learn-Transform services from Model Factories; 54%-76% increase in productivity, 1.5-12 month gain in investment recovery times, 33%-140% increase in daily production units, 6%-18% reduction in product costs, 20% average turnover due to capacity increase increase, an average of 34% reduction in production times, a 5%-100% reduction in overtime time, a 30%-41% increase in total equipment efficiency, an average 12% reduction in energy use, an average 67% reduction in space savings, model transition It can be summarized as a 45%-75% reduction in duration.

Since their establishment, Model Factories have completed Learn-Transform studies in a total of 478 companies and lean project implementation studies in 166 companies. Experiential training, 2,183 awareness training services were provided to 624 companies and 317 cooperation activities were carried out.

Within the scope of establishing the digital transformation infrastructure in Model Factories, studies were carried out in Ankara, Bursa, Konya and Kayseri Model Factories. Within the scope of the digital transformation component of Model Factories, an infrastructure combining Internet of Things (IoT), Production Execution System (MES) and Enterprise Resource Planning (ERP) software on a single platform has been established, enabling the digitalization of the lean applications offered in Model Factories. Human-robot and/or machine-machine collaboration in cooperation with Model Factories, digital support system (SOP), light guidance for assembly operations, logistics operations, real-time cycle time analysis, condition monitoring, operation costing with energy data, digital quality control Usage scenarios such as management, digital performance management, digital product shadow-material traceability are integrated into the

technological infrastructure. With this transformation, Model Factories have expanded their service packages and started to implement digital processes and usage scenarios for companies that want to increase their efficiency and competitive advantage.

In addition to the technological infrastructure installation works, Digitalization Training, Infrastructure Training, End User Training and Usage Scenarios trainings were also completed in order to increase the competencies of the Model Factory staff in the field of digital transformation. Online trainings, which also cover topics such as production logistics management, sales and resource planning, quality and maintenance management, are supported by Model Factory special applications. 30 people, including directors and trainers of Model Factories, attended the training.

It seems likely that Model Factories' competencies in both lean and digital transformation can make serious contributions to green transformation in the future. At this point, it is seen that there is a need for a Model Factory approach in the transformation to a structure where resources, especially energy, are used efficiently, waste is minimized, carbon footprint is reduced, integrated into green transformation and uses green and digital technologies. With the lean and efficient production techniques learned in Model Factories, significant improvements are made in companies' resource use and waste production. The practices to be carried out by Model Factories, especially the Learn-Return Program, will guide businesses in using greener, environmentally friendly and sustainable manufacturing methods. Thus, it will be possible to achieve a sustainable efficiency transformation, including lean, digital and green transformation.

IX. Cybersecurity Strategies

With digitalization, cybersecurity has also become a priority. In the field of cybersecurity, Türkiye:

- Has prepared the National Cybersecurity Strategy and Action Plan.
- Organizes cybersecurity training and awareness programs for the public and private sectors.
- Aims to establish a strong defense mechanism against cyber-attacks.

4. Do you have examples of policy instruments in place to favour the diffusion of frontier technologies in the economy and targeting specific sectors?

In Türkiye, policy tools that support the diffusion of pioneering technologies in the economy and target specific sectors are varied. These policy tools generally aim to strengthen the technology and innovation ecosystem, encourage R&D activities, and accelerate digital transformation in specific sectors. These policy tools aim to increase Türkiye's technology and innovation capacity, thereby promoting the diffusion of pioneering technologies in the economy and enhancing competitiveness in specific sectors. Here are some examples of these policy tools:

I. Incentive and Support Programs

- KOSGEB (Small and Medium Enterprises Development Organization): Provides various grants and loan programs to support the innovative projects of SMEs.
- TÜBİTAK (Scientific and Technological Research Council of Türkiye): Provides funds and programs to support R&D and innovation projects. Programs encourage industry-academia collaborations.

II. Tax Incentives

- R&D Tax Deduction: Tax deductions are available for R&D activities in Türkiye, allowing firms to deduct their R&D expenditures from their taxable income.

III. Technoparks and Technology Development Zones

Technoparks and technology development zones established in various cities across Türkiye provide suitable infrastructure and incentives for companies to conduct R&D and innovation activities. Firms located in these zones can benefit from various tax reductions, grants, and supports.

IV. Sectoral Strategies and Plans

- National Technology Initiative: A strategic initiative aiming to increase domestic production in the fields of industry and technology in Türkiye. It aims to enhance technology development and production capacity, especially in prioritized sectors such as defense, automotive, and health technologies.
- Digital Türkiye (e-Government) Strategy: Aims to digitalize public services and provide faster and more efficient services to citizens, while also aiming to strengthen the digital economy.

V. National and International Collaborations

- Horizon Europe Program: Türkiye's participation in the European Union's Horizon Europe program provides international collaboration and funding opportunities for Turkish researchers and companies.
- Collaborations Between Universities: Collaborations between Turkish universities and international universities encourage technology transfer and innovative projects.

You can visit the website https://www.yatirimadestek.gov.tr/ to learn more about the following examples that support the spread of pioneering technologies in the economy.

- Pre-Competition Cooperation Projects Support
- Technology-Focused Industrial Move
- Incentive for the Establishment of R&D and Design Centers
- Incentives Provided to Enterprises in Technology Development Zones
- Priority investments and project-based incentives included in the Incentive Application System
- Strategic Product Support Program
- Technological Product Investment Support Program
- SME Teknoyatirim
- Clustering Support Program
- KOSGEB – R&D and Innovation Support Programs
- TUBITAK – R&D and Entrepreneurship Support Programs

5. Has your country put in place mechanisms to strengthen industrial capabilities through partnerships among different stakeholders (e.g., university-industry, or private-public)?

Various mechanisms and practices exist in Türkiye to strengthen industrial capabilities through partnerships among different stakeholders, such as university-industry collaborations and public-private partnerships. These mechanisms support the establishment of stronger and more efficient collaborations between universities and industrial companies in Türkiye, contributing to the enhancement of industrial capabilities and competitiveness.
These mechanisms are detailed below:

I. Sector Campus Program

With this program, it is aimed to quickly bring current developments in technology and business world to the academic education curriculum through a partnership between university, industry and public, by ensuring that companies give courses at universities in order to meet the qualified human resources needed by the sectors. Thanks to the program, the most up-to-date information and applications are brought to campuses through companies that are pioneers in their sector. The program is also an important example of implementation in developing university-industry cooperation. It offers students the opportunity to practice the theoretical knowledge they have learned and employment opportunities through internship offers from companies after the course period. The program started to be implemented for the first time in the 2022-2023 Spring semester with the partnership of 20 universities and 20 companies. 36 qualified course content created by 20 companies was delivered to more than 1500 students for 14 weeks with 54 different lesson sessions per week. The success of the first application

ensured that the program attracted great interest from both universities and companies, and enabled it to reach 78 companies and 65 university stakeholders for the 2023-2024 fall semester. Currently, 94 companies and 84 university stakeholders have been reached with the Program, and with the "university-industry cooperation" protocol signed with the Council of Higher Education (YÖK) in February 2024, all public and foundation universities affiliated with YÖK have become able to benefit from the program.

II. Artificial Intelligence Specialization Training

It is a training program that aims to provide qualified candidates with the necessary technical expertise to increase the quality of products and services in the field of artificial intelligence and to strengthen the capacity of human resources. The program is carried out in cooperation with Arçelik, Baykar, Cezeri, Huawei, Havelsan and TÜBİTAK, and aims to train the most needed Data Processing and Integration experts in the field of Artificial Intelligence. The program has 4 main parts: Basic Training, Specialization Training, Graduation Project and Internship Period. In the 30-week program, Data Processing and Integration Expertise training is provided in the fields of databases and cloud systems, as well as subjects such as real-time data processing and model development, parallel processing, data harmonization, data labeling automation and fusion. In 2023, more than 5000 applications were received for the program and 720 candidates were accepted to basic education. 120 candidates who successfully completed the evaluation stages were entitled to participate in specialist training. Candidates who successfully complete the specialist training will begin their internships in relevant companies.

III. Digital Competency Development Training Set that Manufacturing Industry Enterprises Will Benefit from

The Ministry of Industry and Technology has started the preparation of the training set by preparing a comprehensive and innovative curriculum content to be used within the scope of the "Digital Transformation Support Program" and in line with other related targets. The content covers the topics of the 4th Industrial Revolution, digital transformation and digital technologies in general, with a focus on the manufacturing industry sector. In approximately 32 hours of content, titles that can be benefited by all employees such as technical and administrative personnel responsible for manufacturing industry facilities and managers have been determined.

IV. Model Factories

The establishment of Model Factories is carried out by the Chambers of Commerce and Industry, in order to keep local participation at the highest level; It is carried out with the participation of universities, Organized Industrial Zone Managements and other stakeholders. Although Model Factories vary according to the dynamics of each region where they are established, they generally develop under the leadership of the Chambers of Commerce and Industry. These organizations have the capacity to carry out installation work due to the diversity of their member structures and financial possibilities. Model Factories that are operational are expanding their business models over time and deepening their activities through different collaborations with universities. The Model Factory concept prioritizes both public-private and university-industry cooperation, starting from the establishment phase.

V. Technology Transfer Offices (TTOs)

TTOs established within universities facilitate the commercialization of academic knowledge and research, enhancing cooperation between industry and academia. They support activities such as patent applications, licensing agreements, and the establishment of start-up companies.

VI. Technology Development Zones (Technoparks)
Technoparks are regions where universities, research institutions, and industrial companies come together to develop innovative projects and conduct research and development activities. Companies located in technoparks benefit from tax incentives, infrastructure support, and shared facilities.

VII. Clustering and Collaboration Platforms

Sectoral clustering and collaboration platforms bring together stakeholders of a specific industry to conduct joint projects and research and development activities. These platforms promote information sharing and collaborative ventures.

VIII. R&D and Innovation Support Programs

Organizations such as TÜBİTAK, KOSGEB, and Development Agencies offer various programs that support R&D and innovation projects. These programs provide financial support for joint projects between universities and industrial companies, encouraging collaboration.

IX. Artificial Intelligence and Other Pioneering Technologies

Türkiye stands out as a very active, eager and experienced country in the adoption of artificial intelligence and other pioneering technologies. TÜBİTAK BİLGEM Artificial Intelligence Institute acts as a catalyst between technology providers and companies and public institutions in need, facilitating the management of the ecosystem in this field. The Institute plays an important role at the national level by bringing together technology providers and those in need ("match-making"). In this way, actors in the field of artificial intelligence are enabled to collaborate more effectively and innovative solutions are rapidly implemented.

Digitalization and the use of technological tools in the public sector is a high priority for Türkiye. Integrating artificial intelligence into processes enables more effective and efficient delivery of public services. The research ecosystem, especially supported through public funds and R&D funding authorities, demonstrates Türkiye's commitment in this area. Institutions such as TÜBİTAK accelerate this process with funding and support for artificial intelligence projects.

The outputs of artificial intelligence projects constitute an important resource for sectoral needs. The outputs of the projects developed in the sectoral areas of focus can also be used in other sectors with similar needs. For this purpose, it is aimed to benefit from the outputs of previous projects such as libraries and anonymized datasets. In this way, Türkiye is ensuring that artificial intelligence projects become widespread and sectoral needs are met.

Access to and utilization of data is an important issue for Türkiye. The development of artificial intelligence projects using anonymized educational data is supported. Studies in this field ensure that artificial intelligence projects proceed in a safer and more ethical manner. In addition, the sharing of these data sets contributes to the realization of innovative projects by creating an important resource for researchers and developers.

Türkiye has a strong infrastructure that supports the proliferation of AI and other pioneering technologies. For example, the TRUBA HPC (High Performance Computing) infrastructure and the Mare Nostrum supercomputer, of which Türkiye is one of the consortium partners, continue their activities to accelerate the work of researchers and provide secure working environments. In addition, the ARF Supercomputer, recently inaugurated by TÜBİTAK ULAKBİM at the Middle East Technical University, will be used for similar purposes. These infrastructural advantages increase Türkiye's competitiveness in artificial intelligence and other leading technologies and support the development of industrial capabilities. Türkiye's mechanisms that encourage collaborations between universities, industry, public and private sectors play an important role in strengthening industrial capabilities.

Türkiye has many successful examples of the adoption of artificial intelligence and other pioneering technologies. TÜBİTAK's 1711 - Artificial Intelligence Ecosystem Calls is one of the most notable initiatives in this area. First launched in 2022, this call encouraged companies in need of AI solutions to form consortia with technology providers to develop projects. In this process, 22 consortia submitted project applications worth 40,634,001 TL, 10 of which were found eligible for support. These projects include projects in areas such as smart production systems, smart agriculture and food, financial technologies and climate change. In the second call period in 2023, smart education technologies were added to the supported areas. In this period, a total of 32 project proposals were received and 16 were supported. In 2024, the most

recent call is again accepting projects in 5 areas. The deadline for application is July 31, 2024. TÜBİTAK Artificial Intelligence Institute plays an active role in the Artificial Intelligence Ecosystem Calls within the scope of 1711, providing great advantages for national gains and its own development. The Institute plays a central role in transferring academic and industrial know-how to companies. This process contributes to the expansion of knowledge and the development of innovative solutions through business analysis units and transfer laboratories. The consortia formed under the call expand the institute's national and international collaboration network. These networks open the door to more effective collaborations in future projects. Researchers trained in the field of artificial intelligence expand the talent pool of the institute, enabling them to work with better-equipped and specialized people. The budgets obtained through supported projects strengthen the financial resources of the institute, enabling sustainable R&D activities. The Institute plays a key role in achieving the goals of the National Artificial Intelligence Strategy and increases Türkiye's competitiveness in the field of artificial intelligence. The artificial intelligence solutions developed accelerate Türkiye's digital transformation and increase productivity. This process supports economic and technological transformation in the long term by increasing Türkiye's global competitiveness. The Institute contributes to Türkiye's sustainable success by accelerating its development in the field of artificial intelligence. On the other hand, policy instruments have also been developed to support the diffusion of AI and pioneering technologies in the economy. The Public Artificial Intelligence Ecosystem - 2023 call was published by TÜBİTAK under the coordination of the Presidential Digital Transformation Office, encouraging public institutions to develop AI-based solutions. This call aims to increase the efficiency of public institutions and improve service quality. As a result of the evaluations, 5 projects were found eligible for support.

The National Artificial Intelligence Strategy (UYZS), published in August 2021 and followed by an action plan, is an important guide to accelerate Türkiye's development in artificial intelligence and other leading technologies. Under this strategy, TÜBİTAK aims to develop indigenous big language models and productive artificial intelligence applications. TÜBİTAK plays an important role in the development and implementation of these models in collaboration with public institutions, the private sector and academia. These efforts contribute greatly to the growth of the artificial intelligence ecosystem and the promotion of innovation. At the same time, another important initiative supporting Türkiye's development in AI and frontier technologies is the improvement of the Turkish National Science e-Infrastructure for AI. TÜBİTAK ULAKBİM is working on the development of infrastructures such as GPU-supported computing clusters in this field and making them available to researchers. In this process, high-performance computing infrastructures were installed and updated, relevant technical reference architectures were created and pilot applications were planned. Within the scope of UYZS, national competitions are organized for domestic productive artificial intelligence applications. These competitions encourage the private sector, academia and individuals to develop big language models and productive artificial intelligence applications. Competition participants are provided with data infrastructure and successful projects are rewarded. Such competitions increase the chances of success of indigenous productive AI applications and encourage innovation. Furthermore, TÜBİTAK's international and industrial PhD support programs aim to train qualified human resources in the field of artificial intelligence and strengthen university-industry cooperation. These programs encourage internationally successful researchers to be attracted to Türkiye and conduct artificial intelligence studies here. Increasing the number of qualified human resources with PhD degrees, especially in industry, and their active role in industrial projects contribute greatly to Türkiye's artificial intelligence ecosystem. Establishing a "Central Public Data Space" to facilitate public institutions' access to artificial intelligence solutions and making this data available to researchers is also an important step. This mechanism provides technical support for the classification of data held by public institutions and its use in artificial intelligence projects. Thus, data sharing and cooperation among public institutions are increased and the development of artificial intelligence solutions is encouraged.

X. University-Industry Collaboration Centers

These centers act as bridges between universities and industrial companies, offering joint research projects, training programs, and internship opportunities. They also help develop solutions tailored to industry needs.

XI. Joint Laboratories and Research Centers

Joint laboratories and research centers provide high-tech infrastructures where universities and industrial companies can collaborate on R&D activities. These centers facilitate both academic and industrial research.

XII. Industrial Internship and Training Programs

Industrial internships and training programs for university students enable them to gain industrial experience. These programs also help in training the qualified workforce needed by industrial companies.

XIII. Project Markets and Fairs

Project markets and fairs are events where universities, researchers, and industrial companies can showcase their projects and discuss potential collaborations. These events offer significant opportunities for establishing new partnerships and promoting existing projects.

XIV. Grants and Funding Programs

International grant programs like EU funds, Horizon 2020, and various domestic grant programs support joint projects between universities and industrial companies, enabling the realization of innovative works.

XV. Mentorship and Consultancy Services

Mentorship and consultancy services between academicians and industry professionals enhance knowledge and experience sharing, increasing the success of joint projects. These services also help in developing entrepreneurship and innovation capacities.

6. How can international cooperation support the uptake of new technologies and the development of technological capabilities in your country and ensure that industrial policies will benefit all and do not worsen inequality?

   International cooperation can support the adoption of new technologies and the development of technological capabilities through knowledge and technology transfer, training programs, joint R&D projects and financial support. In addition, policies developed within the framework of international standards and good practices can make industrial policies more sustainable.

   Additionally, experience and knowledge sharing, technology transfer, joint ventures and investments, R&D collaborations (TUBITAK and EU Funds), international talent transfer and student exchange, global training programs, scholarships and technical visits strengthen the adoption of technologies and the development of technological talents.

   Regional development projects, regional incentives, fair and transparent regulations based on the employment and production potential of regions, and ensuring an inclusive and fair education system can ensure that industrial policies benefit everyone and do not worsen inequality.

7. What can do the UN CSTD to support an economic transformation that enhances your country productive capabilities and foster an inclusive digital transformation?

   Digital transformation is one of the most significant economic and social changes of our time. This transformation not only enhances the competitiveness of countries but also has the potential to promote inclusive and sustainable development. Türkiye aims to accelerate its digital transformation process to increase its economic growth and productivity capabilities.

   In this context, the United Nations Commission on Science and Technology for Development (CSTD) is a significant international actor that can contribute to countries' digital transformation and economic development processes. CSTD can guide countries in developing digital

transformation and technology-based economic policies. The UN's ICT draft resolutions encourage member states to develop the digital economy and create innovative policies. Leveraging CSTD's expertise in creating digital economy strategies and action plans can enable the development of internationally compliant and sustainable policies. On the other hand, information sharing and cooperation are of great importance in the digital transformation process. CSTD can contribute to the faster progress of countries in this process by sharing successful digital transformation examples from other countries.

Please indicate contact person(s) responsible for projects/policies and international collaboration in this context 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