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

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Contribution by Turkey

to the CSTD 2021-2022 priority theme on "Industry 4.0 for inclusive development"

PRIORITY THEME 1: Industry 4.0 for inclusive development

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

Dear CSTD member,

As you are aware, the CSTD 24th annual session selected "Industry 4.0 for inclusive development" as one of the priority themes for its 25th session (2021-22 period).

This priority theme is directly relevant to SDG 9 on industry, innovation and infrastructure. As highlighted by the Technology and Innovation Report 2021, we live at the beginning of a new technological revolution around Industry 4.0 technologies such as AI, robotics, Internet of Things, and blockchain. The way to be prepared to benefit from Industry 4.0 is by promoting the use, adoption, adaptation, and development of technologies associated with this new technological wave. This priority theme will focus on the challenges and prospects for developing countries to pursuit an industrialization path considering the emergence of Industry 4.0. This may include the possibility of bypassing intermediate stages of technology that other countries have historically passed in their development process, often referred to as "leapfrogging". The priority theme will cover the impact of this new technological revolution on the traditional channels for technological learning, and innovation in developing countries, including FDI and participation in Global Value Chains. It will examine the opportunities for "leapfrogging". It will also consider the role of public policies in enabling vulnerable groups and communities to benefit from Industry 4.0, including through better and more equitably accessible jobs.

Questions to be addressed include: How can developing countries take advantage of the window of opportunity presented by the Industry 4.0 technologies for technological upgrading and catch up? What can countries do to ensure that Industry 4.0 does not increase inequality? What is the role of international cooperation in facilitating this process?

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 on 17-19 November 2021. In this context, we would like to solicit inputs from the CSTD members on this theme. We would be grateful if you could kindly answer the following questions based on your experience from your country or region.

1. What are the national strategies, policies, laws, programmes and initiatives concerning Industry 4.0 in your country?

   Turkey takes its place in Industry 4.0 era by calling its perspective the "National Technology Initiative and Digital Turkey". Therefore all strategies, policies and programmes are around this perspective.

   General Directorate for National Technology was established under The Republic of Turkey Ministry of Industry and Technology on 14 April 2020 to make arrangements to pave the way for technology transformation.

   Some of duties and power of the General Directorate for National Technology are;

   • Contributing to the implementation of high-impact programs and projects to improve Turkey's technological competence within the scope of the National Technology Initiative

   • To carry out activities for the development of individual competencies and social awareness and culture in technology development and digital transformation of individuals and businesses in cooperation with relevant stakeholders in line with the objectives of the National Technology Initiative

   • To take measures to increase the competencies of individuals and businesses in subjects such as big data and artificial intelligence, to develop and expand smart systems based on these technologies, to implement support and incentive programs, to carry out programs and projects,

• To take the necessary measures in coordination and cooperation with the relevant public institutions and organizations for the development of digital economy applications and the growth of the ecosystem in this field to increase the economic benefit of digitalization, and to contribute to the creation of legislation; To carry out programs and projects for the development of digital economy infrastructures and applications in parallel with digital technologies and trends,

• To take the necessary measures, develop and carry out applications to ensure the development and competitiveness of the informatics and advanced technology sectors; keeping the register of businesses operating in these sectors; Harmonizing the technical regulations regarding the products of the informatics and advanced technology sectors, excluding those used in the electronic communication sector, preparing and implementing the technical legislation and the relevant standard lists, determining or having the features that will be the basis for the inspection of the products that do not have technical regulations and standards; To determine the qualifications that conformity assessment bodies and technical service organizations to be authorized within the scope of technical regulations, to assign these bodies, to temporarily suspend or cancel the assignment when necessary.

Small and Medium Enterprises Development Organization (KOSGEB) and The Scientific and Technological Research Council of Turkey (TÜBİTAK) which are organizations of The Republic of Turkey Ministry of Industry and Technology, open grant programs to support the digital transformation of SMEs.

11th National Development Plan (NDP), 2023 Industry and Technology Strategy and Smart Production Systems Technology Roadmap can be noted as main policies and strategies concerning Industry 4.0.

In July 2019, Turkey adopted the 11th National Development Plan (NDP) with a 5-year perspective, i.e. covering 2019-2023.

Policies and strategies of digital transformation of conventional sectors are given place to the Eleventh Development Plan of Presidency of the Republic of Turkey Presidency of Strategy and Budget. Under the “Digital Transformation” and “R&D and Innovation” sections of the strategy, policies and measures are given in the objective of boosting productivity and competitiveness in priority sectors by accelerating digital transformation and strengthen the R&D and innovation capability of the manufacturing industry to enable value-added production and to increase the capacity of innovative product development and to provide an innovation-based structure.

The 11th Development Plan sets forth Turkey’s long term vision for economic and social development. It is the main roadmap for public policy which leads all governmental institutions with regard to preparation processes of strategic and action plans. The plan lays down the main pillars of STI policies, emphasizing the need to develop the capacity to produce and use knowledge and to focus R&D and innovation activities both in academia and in private sector that support high value-added production, particularly through an efficient R&D and innovation ecosystem. Additionally, the Plan emphasizes entrepreneurship and commercialization activities tailored for different actors in industry (SMEs, big size enterprises etc) and the transfer of knowledge and technology (enabling socio-economic impacts of R&D results). Concerning the R&D and innovation, enhancing the capacity for R&D and innovation capabilities, increasing the value added production and the share of high-tech sectors within both manufacturing industry and exports and ensuring a convenient environment for innovation are determined as the primary goals. To this end, R&D and innovation support systems are determined to be evolved to an integrated structure from basic research to commercialization at every phase of R&D and innovation; while the distinctive structures and characteristics of mid-high tech and high tech sectors will be favored. In this context, priority sectors are identified as chemical industry, pharmaceuticals and medical devices, electronics, machine and electrical equipment, automotive and rail systems. Artificial intelligence, internet of things, augmented reality, big data, cyber security, energy storage, advanced materials, robotics, micro-nano-electromechanical systems (MEMS/NEMS), biotechnology, quantum technologies, sensors and additive manufacturing technologies are determined as the critical technologies, where the

human resources is to be further supported, infrastructures to be established and roadmaps to be developed.

Increasing the competitiveness in priority sectors and improving the R&D and innovation capacity and developing internationally competitive and high value added new sectors, products and brands in the critical technologies have been given utmost importance within the Plan.

Turkey has published the 2023 Industry and Technology Strategy of The Republic of Turkey Ministry of Industry and Technology. The strategy has five pillars, namely, High Technology and Innovation, Digital Transformation and Industrial Move, Entrepreneurship, Human Capital, and Infrastructure. Sub strategies (namely, Digital Transformation of the Industry, The National Artificial Intelligence Strategy, 5G and Beyond Technologies Strategy, Mobility Vehicles and Technologies Strategy, Smart Life, Health Products and Technologies Strategy, Digital Transformation of Finance and Commerce Strategy) serving this umbrella strategy have been developed and are in the process of publication and implementation.

The main purpose of the Digital Transformation of the Industry Strategy is to provide efficiency and self-efficacy to increase the competitiveness of Turkey. Targets of the strategy are as follows:

1. Establishment of the proposed governance mechanism for the industry's digital transformation program with the cooperation of the public and private sectors.
2. Completion of the development of tools that will ensure the management of the digital transformation of the industry, monitoring its performance and efficient use of resources.
3. Announcement of the digital transformation support program.
4. Completion of the infrastructure for digital transformation.
5. Gaining new skills and competencies that will enable digital transformation to the existing and emerging workforce.
6. Development of competitive products and solutions in Operational Technologies.
7. Developing competitive products and solutions in Information Technologies.
8. Creation of competitive products and solutions in Transactional Technologies.

Digital transformation in manufacturing industry is considered critical in Turkey. Through the coordination of TÜBİTAK (the Scientific and Technological Research Council of Turkey) under the framework of the Ministry of Industry and Technology, all sectoral stakeholders have participated towards the establishment of the Smart Production Systems Technology Roadmap in 2016. In total, 29 critical products have been identified in the context of 8 critical technology areas that are determined in this roadmap, namely Big Data and Cloud Computing, Digitalization, Cybersecurity, Internet of Things, Sensor Technologies, Additive Manufacturing, Advanced Robotics, Advanced Automation and Control Technologies.

The critical products/technologies, which are identified as priority RDI themes of Smart Production Systems for Turkey, are as follows:

- Development of algorithms and applications for secure, smart and scalable end-to-end cloud service platform, which also enables and predictive maintenance of data
- Development of cyber security solutions for Industry 4.0
- Simulation, modelling and virtualization technologies for Industry 4.0
- Establishment of interoperable, secure and reliable industrial IoT digital platform and development of high added value smart service applications
- Development of Software and/or Hardware for Machine-to-Machine, Machine-to-Human, Machine-to-Infrastructure Communication
- Development of physical, chemical, biological, optic, micro-nano sensors for industrial use

- Development of smart manufacturing robots, equipment, software and executive systems which are competitive in global markets, easily accessible by SMEs
- Development of raw materials, production machines and required software and automation systems for additive manufacturing. Additive Manufacturing Machines, Additive Manufacturing Materials, Additive Manufacturing Software
- Development of smart manufacturing execution system and components, as well as required middleware technologies

Dedicated R&D and innovation supports have been provided to universities, SMEs and large industrial organizations for the development of critical technologies serving digital transformation since 2012 by TÜBİTAK.

So far, the top area based on the distribution of the total budgets of the supported projects has been “sensors, electronic circuits and microelectromechanical systems” with a share of 21% in first place. This has been followed by “communication systems” with a share of 20% and subsequently, two areas each with a share of 15% as “artificial intelligence” and “robotic-mechatronics”. The area of “data analytics” takes in fifth place with a share of 10%.

The New “RDI Priority Areas (2020-2021) Study conducted by TUBITAK includes various technology intensive sub-priorities in the fields of ICT, health, food, energy, machine&manufacturing and automotive. In this context, in ICT sector, artificial intelligence, internet of things, big data and data analytics, image processing technologies, robotics, software technologies, cloud computing, broadband technologies are all considered to be priority technologies for near future; and all of which are the basis of digitalization, have been prepared along with detailed contents and technological readiness levels. 64 of the 154 RDI priority areas, approximately 42% of all “RDI Priority Areas (2020-2021)”, are the ICT and digitalization related ones.

Since 2020, TÜBİTAK has been giving priority to RDI project proposals within the evaluation phases of TÜBİTAK 1001 - Scientific and Technological Research Projects Support Program, TÜBİTAK 1501 - Industry R&D Projects Support Program and TÜBİTAK 1507 - SME R&D Start Support Program if the proposal is concerned at least one of these determined RDI Priority Areas. Projects dedicated to develop the given priority technologies and products are supported by TÜBİTAK within the scope of R&D and innovation support programs or through the Move Program within the scope of the National Technology Move by the Ministry of Industry and Technology.

Some Initiatives:

Model Factories

Eight Model Factories (Capability and Digital Transformation Centers), established with the Ministry of Industry and Technology initiative, provide consultancy and training solutions for businesses to complete their lean and digital transformation. New model factories are planned to be established in different areas of Turkey in the coming years. The businesses which demand services from Model Factories can benefit from financial support through the government agency KOSGEB and Development Agencies.

Fourth Industrial Revolution Center - The Center for the Fourth Industrial Revolution (C4IR)

4. Industrial Revolution Center - The Center for the Fourth Industrial Revolution (C4IR) is a multi-stakeholder initiative that supports global collaborations and develops new policies to accelerate the benefits of science and technology. The center was launched in December 2020 by WEF, MESS, and Ministry of Industry and Technology. Briefs about the organization:

- Maximizing the benefits of science and technology to the society
- As of January 2020, WEF's 7th affiliated organization (Affiliate Center)

- Main working titles; Internet of Things, Robotics, Smart Cities, Artificial Intelligence and Machine Learning
- Active projects; Increasing the Impact of Industrial IoT in SMEs, Responsible Use of Artificial Intelligence, Human-Oriented Artificial Intelligence for Human Resources, Shaping Future Technology Control: Artificial Intelligence and Machine Learning.

Accelerating Digital Transformation of SMEs Through IoT

As MoIT, we are a stakeholder of the project "Accelerating digital transformation of SMEs through IoT" operated jointly by "Fourth Industrial Revolution Center" and "TÜSSİDE".

The eventual aim of the project is to create a model for "building roadmap for companies". This project will be the pilot for the model and it comprehends the following steps:

- Digital maturity assessments of SME's
- Matching the technology users and technology providers and creation of "use case senarios pool"
- Accumulating and keeping the application scenarios in an industrial cloud.

D3A Digital Transformation Assessment Tool

'D3A Digital Transformation Evaluation Tool' was developed by Boğaziçi University - Industry 4.0 Platform. TUBITAK - TÜSSİDE (Turkish Management Science Institute) is to ensure the implementation of these assessment tools for SME's. Assessment tool focuses on SME's which corresponds to the 99 percent of Turkey's industry and this tool will provide road maps for them. Focusing on five dimensions which are organization, customer, product development, supply chain and production management, D3A aims to determine the needs of SME's and to run their digital transformation processes smoothly.

Besides the actions of the Republic of Turkey Ministry of Industry and Technology, other ministries and presidencies put effort into digital transformation.

2020 – 2023 National Cyber Security Strategy of Republic of Turkey Ministry of Transportation and Infrastructure addresses to security criteria of new generation technologies such as artificial intelligence, internet of things, blockchain, and 5G, which have a place in our lives, will take place as a priority in the cyber security plans of the near future, and "identify the areas of use of artificial intelligence and blockchain technologies for cyber security, and determine the domestic and national technologies to be developed.

2020 – 2023 National Smart Transportation Systems Strategy Document and Action Plan of Republic of Turkey Ministry of Transportation and Infrastructure states strategies that aim to create a sustainable, productive, safe, efficient, innovative, dynamic, environment-friendly intelligent transport network that creates added value and integrated with all transport modes using the latest technology while making use of national resources.

Republic of Turkey Ministry of Environment and Urbanisation published the 2020-2023 National Smart Cities Strategy and Action Plan which focused on integrated city solutions based on data. Within the scope of this document; A protocol was signed between the Ministry of Environment and Urbanization, the Ministry of Industry and Technology and the Municipality of Esenler, and a Smart City Project was initiated with the vision of "Esenler-The People-Oriented, Peaceful, Safe and Smart City of the Future", which will set an example and model for all cities in Turkey. Within the framework of the Smart City concept in the project, the following 10 focus areas and 108 applications were determined and feasibility studies were completed for prioritization.

- Disaster and Emergency
- Smart Environment
- Smart Economy
- Smart Energy
- Smart Security
- Human Oriented Smart City

- Smart Health
- Smart Transportation
- Smart Structure
- Governance Mechanism

On the other hand, “Esenler Smart City-Oriented Specialized Technology Development Zone” was established within the scope of Esenler Smart City project, which is aimed to be a technology center integrated with the city.

Last but not least, the Presidency of the Republic of Turkey Digital Transformation Office aims to implementation of the digital transformation ecosystem by enhancing the performance of public institutions and increasing the efficiency and quality of their services in line with the goals, policies and strategies set by the President of the Republic of Turkey.

Besides national policies are implemented by MoIT regional policies are formulated and supported by development agencies and regional support programs.

KOSGEB (Small and Medium Enterprises Development Organization of Turkey) SUPPORT PROGRAMS REGARDING INDUSTRY 4.0:

KOBİGEL Support Program

KOSGEB has announced two Call for Proposals in order to support digital transformation of SMEs in 2019. First program aims to support SMEs which are developing digital technologies applicable in industry sector. Capabilities of digital technology developers is fostered by a project based program including 1.000.000 TRY (115.000 USD) financial support. Second program’s target is SMEs which are acting in industry sector. 1.000.000 TRY (115.000 USD) financial support is provided to industrial sector SMEs which are aiming to adapt digital technologies to their manufacturing and business processes.

Calls for proposals comprise 8 smart digital technologies: Big Data, Internet of Things, Industrial Robot Technologies, Smart Sensor Technologies, Artificial Intelligence, Cyber Security, Smart and Flexible Manufacturing, irtual Reality / Augmented Reality. Calls for proposals have been announced in 2019 and repeated in the following years. At total, 936 projects have been approved up to now.

So as to encourage interaction between technology developer SMEs and industrial sector SMEs;
- Intent of purchase letter provided by an industrial SME was made obligatory for technology developer SMEs.
- Prioritization rules were defined for industrial sector SMEs which intend to procure digital technologies from technology developer SMEs.

Strategic Product Support Program

This program provides funds for SMEs’ investment projects for manufacturing high added value products in the medium-high-and high-technology sectors and increasing the production of critical products for the development of these sectors in Turkey within the scope of Technology-Oriented Industry Move Program conducted by Ministry of Industry and Technology (MoIT). The program offers up to 6.000.000 TL financial support with a 60 % grant ratio for projects up to 36 months aiming production of the privileged products mentioned in the calls for proposals of Technology Oriented Industry Action Program.

Machinery-equipment, software, personnel, reference sample, knowledge transfer, test, analysis, calibration, training-consultancy, design and other service procurement costs are eligible for granted projects of SMEs. MoIT publishes a list for Privileged Products and calls for specific areas through this list. In 2021, three calls (Mobility Call, Call for Structural Transformation in Production and Call for Health and Chemical Products) were put into service

for investments of 722 kinds of products. Digital Transformation Call will be published by MoIT in the upcoming days. Products related with Industry 4.0 are also in the list of investments to be financially supported via these calls. Products related with Industry 4.0 in these calls:

- Big data collection platform (data validation, data integrity, data privacy, data labeling, heterogeneous data support)
- Internet of industrial things platform
- Digital Twin technologies
- Blockchain technologies (product traceability, digital product marketing, etc.) and infrastructure
- Advanced technology embedded sensor systems such as MEMS/NEMS and optical technologies to be used in internet of things applications
- Extreme-proof sensors
- Wearable technologies that can send data to the cloud and receive commands, compatible with the Internet of Things
- Cyber security technologies based on artificial intelligence and deep learning
- System-on-Chip technologies
- Robotic process automation technologies
- Autonomous/Semi-Autonomous Industrial and Service Robots
- Hybrid manufacturing systems

2. What are the key industries that are pioneer Industry 4.0 innovation in the country? List the key actors in the national ecosystem of innovation related to Industry 4.0 in your country (firms, universities, financial institutions, regulators)? What are the key networks of the ecosystem in your country (including online networks, innovation hubs, forums, etc.)?

   The public sector aims to lead technological transformation with its actions. The automotive and manufacturing sectors are pioneer adopters of Industry 4.0 in order to maximize production, to minimize costs and work accidents.

   Generally, corporate companies, start-ups, technology transfer offices are the key actors of the ecosystem. IBM, SAP, Microsoft, KoçSistem, Turkcell are some of the service providers for Industry 4.0 solutions. On the other hand, start-ups are mostly focusing on the digitalization of conventional machines. Since Industry 4.0 is new to the conventional sectors, there is huge potential for start-ups. ServisSoft, Hubbox, Bren Energy are some of the start-ups that could be named as promising Industry 4.0 start-ups. Technology Transfer Offices (TTOs) are another contributor to Industry 4.0. TTOs lead to the implementation of technology practices in Turkey.

   One of the business association which called TÜSİAD publishes reports about Industry 4.0. Also, the association carried out TÜSİAD SD2 Digital Platform to bring together digital solution

   In line with the importance given to the digital transformation of the industrial sector in the Eleventh Development Plan of Turkey, the issue of “digitalization in the manufacturing industry” has been among the priority themes of the government since 2019. SMEs in the industrial sector need to adapt themselves to digital technologies for the value-added production-oriented transformation of both industry and industrial workforce. The digital transformation of the industry as a strategic priority area has some fundamental gains such as increasing resource productivity and competitiveness in general.

   The Eleventh Development Plan defines automotive, chemistry, pharmaceutics and medical devices, electronics, machinery-electrical equipment, and rail system vehicles as priority sectors. In addition, the 2023 Industry and Technology Strategy aims at the digital

transformation of the manufacturing industry and seeks to support this transformation with the national technology move program.

The Capability and Digital Transformation Center (Model Factory) project, which started in 2015, is one of the critical initiatives of the Ministry of Industry and Technology in this area. Model Factories, which provide applied training and consultancy services especially for SMEs, started to operate in critical industrial cities, and the number of these training centers will increase in the coming period.

Key actors both in policymaking and in the implementation of national strategies can be listed as follows: Ministry of Industry and Technology, Chambers of Industry and Commerce, NGOs, international organizations such as UNDP, and KOSGEB, which manages the government's financial support for manufacturing SMEs.

These actors are involved in all processes, from policymaking to implementation. The ministry is at the center of policy networks and manages communication between stakeholders and actors as a top-level government agency. Model Factories, which are also considered as a hub of digitalization efforts, are coordinated at the national level, and a common technical experience is gained by sharing information among them.

Industry 4.0 covers a large variety of sectors but manufacturing and ICT seem to be the pioneering sectors.

The Ministry of Industry and Technology is the most active governmental body in administration of efforts in Industry 4.0 while R&D is mainly supported by TÜBİTAK (the Scientifical and Technological Research Council of Turkey).

The R&D is conducted in universities, private sector, technoparks and R&D institutes. So there are a lot of actors in R&D. The key factor of success in R&D is the collaboration between these different actors. Various mechanism are designed to increase these kind of collaboration. TÜBİTAK SAYEM - Industrial Innovation Networks Mechanism can be counted among these efforts. In order to strengthen the industrial innovation networks in Turkey, considering the smart specialization in industrial innovation hubs; policy tools that are more target-oriented, collaborative, focused on the long-term, and directed to high value-addition are being put forward to strengthen aspects of smart specialization and inclusiveness in the local ecosystem. Through "Industrial Innovation Networks Mechanism (SAYEM)", established in 2018, private sector firms, especially those that contain an R&D and product design centres, will form a network with other firms of the value chain of the targeted technology-based product together with end-users, technology development zones and universities.

The objectives of SAYEM can be listed as below:

- To promote the innovative network formations, leading to creation of product road maps
- To form a network with other firms from the value chain of the targeted technology-based product, together with end-users, technology development zones and universities.
- To enhance smart specialization activities in industrial innovation hubs including firms, especially those that contain an R&D and product design centre,

Moreover, Digital Transformation Platform in Industry started to its activities in 2016 in the leadership of Ministry of Industry and Technology in order to ensure effective cooperation between all stakeholders in the process of creating and implementing policies. Ministry of Industry and Technology, Union of Chambers and Commodity Exchanges of Turkey, Turkish

Exporters Assembly, Turkish Industrialists and Businessmen Association, Independent Industrialist and Businessmen's Association, International Investors Association and Turkish Technology Development Foundation aims to increase the competitiveness of the industry for sustainable and efficient production, to implement smart production systems, and to benefit from the opportunities offered by technology in all rings of the value chain under this platform. The platform prepared the " Roadmap of Digital Transformation for Manufacturing Sector".

KOSGEB as a governmental organisation has a wide network of SMEs and field experience in terms of supporting SMEs. These capabilities can be used to improve Indusrty 4.0 concept among SMEs.

3. What are the challenges that your government have faced or may face for promoting Industry 4.0 in your country to contribute to national development priorities and accelerate the progress towards the SDGs?

Industry 4.0 brings with its new challenges such as adapting public and private sector policies to digitalization, integrating them into global supply chains and meeting the needs of the labour market talent pool. Countries and societies face new challenges, unlike previous periods. On the one hand, development is achieved in industry and technology, on the other hand, it is necessary to create solutions to the new generation problems caused by them. This, in turn, necessitates new approaches in accordance with the requirements of the era. While the "industry 4.0" process presents important opportunities for humanity, it also causes all balances to change at the level of countries and the competition conditions to be reshaped.Labor market readiness and financing needs for the transition are projected to be the biggest challenges on the way to Industry 4.0 in Turkey similar to other countries.

The difficulties encountered can be listed as follows.

- The high cost of implementation and sustainability, and difficulties of complex structure of Industry 4.0. production process
- Lack of Turkey's dominance in production technologies by means of technology development
- Challenges in creating new markets
- Lack of awareness about Industry 4.0 in some sector groups
- Difficulties in attracting the digital workforce and the low-levels of ability of the current workforce to develop digital solutions

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

Our experience in digitization studies for the manufacturing industry shows that good practice examples are much more effective and motivating, especially in SMEs. Therefore, there is a need for international cooperation programs that focus on knowledge and experience sharing. The practical contents of such programs will also increase the success of knowledge dissemination.

Therefore, all stakeholders must strive for increasing the communication with the others and crating collaboration options. In this aim governments can support and create mechanisms to improve collaboration and communication.

On the other hand, KOSGEB, as a governmental organisation has access to thousands of SMEs via its network and directorates. These instruments shall be used firstly to increase

awareness about Industry 4.0 concept among SMEs. Since this is a relatively new concept among most SMEs, general training programs, seminers shall be conducted about Industry 4.0

Before taking any actions about the concept, the awareness of SMEs should be measured. To begin with, a pilot sector with a a pilot group of SMEs can be chosen and various studies, surveys, etc. shall be made among these groups to understand their scope of view and awareness for Industry 4.0 and then a regional or sectoral work plan among these SME pilot groups can be developed.

After understanding the role of Industry 4.0 among SMEs (through pilot groups) further actions (training programs, detailed field surveys/studies, possible support models) can be planned by KOSGEB among SMEs.

The key factor is a strong communication between different actors. All stakeholders must strive for increasing the communication with the others and crating collaboration options. In this aim governments can support and create mechanisms to improve collaboration and communication.

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

Benchmarking practises could be developed between domestic industry firms and international firms that achieved the transformation of Industry 4.0. Also integration into international networks such as Digital Innovation Hubs (DIH) of Europe and policy making process will both contribute digitalisation of firms and enable policy makers to develop inclusive and sustainable policies.

On the other hand, the experience of Covid-19 has shown that as long as developments in science, technology and innovation remain at the local level (or only at the level of a few developed countries), the overall gain from these developments will be limited. For this reason, international community can provide platforms for knowledge and experience sharing.

In addition, it is an important question that directly concerns the whole world what kind of social problems the destructive/transformative effects of Industry 4.0 on the workforce may cause in the medium and long term. In this direction, a supranational strategy should be determined and evaluated together with possible population movements and other demographic trends.

Besides, national awareness is the key factor for distributing Industry 4.0 concept to organisations and companies. Corporate companies and governmental organisations can take the lead to set out this concept among themselves and other target companies.

KOSGEB as a governmental organisation has the necessary power and infrastructure to implement Indusrty 4.0 among its target SMEs by having the capability of creating effective support program models and having important contact points in the field.

In this manner, international protocols, agreements can be prepared with KOSGEB directly or as a partner. KOSGEB as a governmental organisation has all the necessary means to reach many SMEs in Turkey. These capabilities can be used to implement and further enlarge Industrial 4.0 concept within SMEs in Turkey.

Lastly, having the opportunity to learn from other countries' experiences makes a lot of difference. In this view sharing experiences and making ground for this share has an important role. So we believe that the CSTD has a critical role in gathering quality information about experiences of other countries.

6. Could you suggest some contact persons of the nodal agency responsible for projects/policies and international collaboration in this context as well as any experts (from academia, private sector, civil society or government) dealing with projects in this area? We might contact them

directly for further inputs or invite some of them as speakers for the CSTD inter-sessional panel and annual session.

- The Ministry of Industry and Technology
- Small and Medium Enterprises Development Organization of Turkey (KOSGEB),
- The Scientific And Technological Research Council Of Turkey (TUBITAK) (Contact person on Industry 4.0 efforts in Turkey: A. Melis YURTTAGÜL KOCATÜRK: TÜBİTAK Director of STI Policy Department e-mail: melis.yurttagul@tubitak.gov.tr)
- Union of Chambers and Commodity Exchanges of Turkey,
- Turkish Exporters Assembly,
- Turkish Industrialists and Businessmen Association,
- Independent Industrialist and Businessmen's Association,
- International Investors Association
- Turkish Technology Development Foundation

7. Do you have any documentation, references, technological assessments, future studies or reports on the priority theme in your country or region?

   National strategies, action plans and other published reports can be reached below;

   - Eleventh Development Plan https://www.sbb.gov.tr/wp-content/uploads/2020/06/Eleventh_Development_Plan-2019-2023.pdf
   - 2023 Industry and Technology Strategy https://www.sanayi.gov.tr/assets/pdf/SanayiStratejiBelgesi2023.pdf
   - National Artificial Intelligence Strategy 2021-2025
   - 2020 – 2023 National Smart Transportation Systems Strategy Document and Action Plan
   - Industry 4.0 in Turkey as an Imperative for Global Competitiveness - An Emerging Market Perspective
   - Digital Turkey Road Map https://cdnendustri40.4flyy.com/file/e267e931e0794d50b5e4ba40306cffcb/tsddtyh.pdf
   - Digital Transformation in Industry https://www.ttgv.org.tr/eng/images/publications/6005a78999c30.pdf
   - The Smart Production Systems Technology Roadmap in 2016 (only available Turkish): https://www.tubitak.gov.tr/sites/default/files/akilli_uretim_sistemleri_tyh_v27aralik2016.pdf

Please send your responses and any further inputs on the theme to the CSTD secretariat (stdev@unctad.org) by 6 September 2021. We look forward to receiving your valuable inputs.

Sincere regards,

CSTD secretariat