



Innovate  
UK

# Innovate UK Global Expert Mission Report

## Advanced Manufacturing & Materials in Türkiye

December 2022

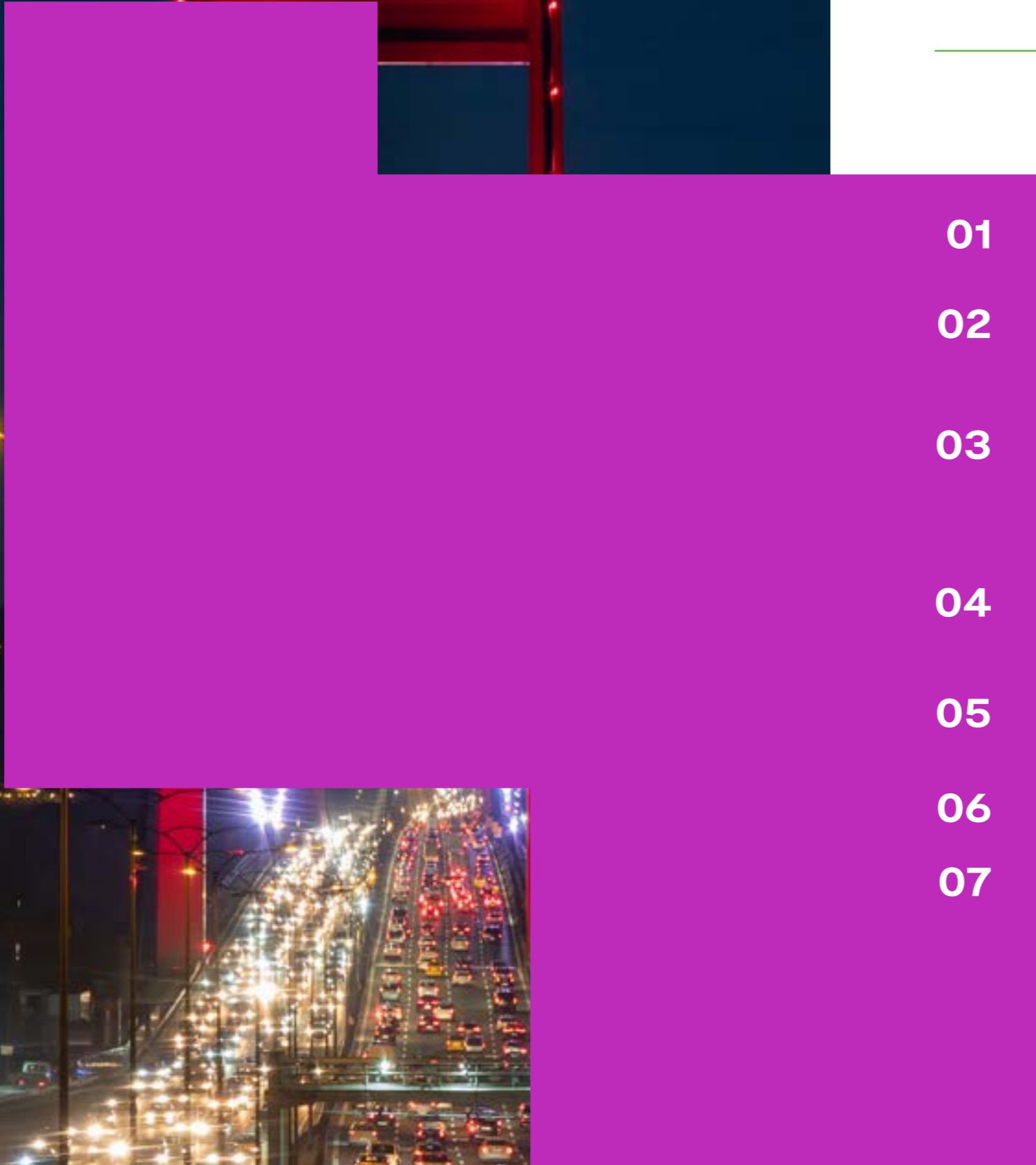


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## 01. Introduction

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### 1.1 Innovate UK Global Expert Missions

Innovate UK, part of UK Research and Innovation (UKRI), is the UK's national innovation agency. Innovate UK supports business-led innovation in all sectors, technologies and UK regions. Helping businesses grow through the development and commercialisation of new products, processes, and services, supported by an outstanding innovation ecosystem that is agile, inclusive, and easy to navigate. Innovate UK is part of the Innovate UK group, and its primary objective is to link innovators with new opportunities and partners, thereby accelerating ambitious ideas into real-world solutions beyond their present thinking.

In 2017, Innovate UK launched the Global Expert Mission (GEM) programme to support UK businesses' efforts to become global enterprises. This programme is delivered by Innovate UK, often in partnership with the Science and Innovation Network (SIN) and helps to inform Innovate UK's global strategy by identifying opportunities for UK businesses and facilitating partnerships and collaborations with key economies. As innovation continues to be a global effort, GEMs play a significant role in supporting UK businesses' international ambitions.

## 1.2 Mission Overview

A group of seven UK delegates, all active in the UK Advanced Manufacturing industry, met with key stakeholders from both private and public sector organisations in Türkiye.

The mission was held in three separate locations in Türkiye over five days. UK delegates started in the capital Ankara, moving on to Bursa, then spending three days at various locations in Istanbul.

The GEM focused on how materials and manufacturing organisations can be more sustainable and resource-efficient, leading to increased resilience and/or technological advancement. **Innovate UK's Materials and Manufacturing Vision 2050** is guided by three strategic imperatives that are mutually supportive. It sees future-looking organisations in materials and manufacturing as:

1. Net zero and resource-efficient
2. Resilient and responsive
3. Technologically advanced and digital

The 5 core areas of Innovate UK Materials and Manufacturing Vision 2050 are:

- **Materials for the future economy** – discovery, scaling, accelerating adoption of advanced, bio-based, and sustainable materials, and the associated processing.
- **Smart design** – through-life and multidisciplinary design engineering with the support of digital tools to de-risk and prototype innovative ideas.
- **Resilient supply chains** – procurement of raw materials and components, and the repurposing of emissions, solid waste, and industrial water back into manufacturing.
- **World-class production** – automated and adaptive manufacturing, productivity enhancement, predictive maintenance, biomanufacture and resource efficiency.
- **Longer in use and reuse** – sustainable consumption of resources and reuse, repair, recycling, remanufacture, and ultimate disposal of products and materials.

This mission focused on two of the core areas - materials for the future economy and world-class production. However, we also considered the importance of enabling areas such as clean energy, as well as proactive regulations and policy, future skills, networked relations, and evolving value models. These factors are critical in transforming towards a more resource-efficient and sustainable future.



## 1.3 Mission Objectives

The objectives of the UK-Türkiye GEM were:

- To help determine how Innovate UK can best support UK businesses more effectively and efficiently when considering innovation partnerships with Türkiye.
- To provide insights into where there are synergies in policy and strategy between the two countries in advanced manufacturing and determine whether there is an appetite for further collaboration.
- To understand the Turkish market and key stakeholders in advanced manufacturing and develop strategies for long-term engagement for new products and services.
- Identify challenges and opportunities for developing innovative products and services when considering collaborations with Türkiye.

## 02. Overview of Science & Innovation in Türkiye

Türkiye offers great potential prospects for the Advanced Manufacturing sector. Türkiye's sizeable population, dynamics, and advantageous geographic position as a bridge between Europe and Asia, have made the country an important manufacturing and distribution hub.<sup>1</sup>

Türkiye positions itself in the global value chain by leveraging lower labour costs and flexible production capabilities. Manufacturing's share of GDP has increased to 18.83% in the last decade, and Türkiye aims to boost it to 21% by 2023 through its 2023 Industry and Technology Strategy.<sup>1</sup> Early adopters of advanced manufacturing in Türkiye include the automotive (Ford, Renault) and aviation industries, both dominated by major international companies with many local suppliers who must meet the latest standards and technological requirements. In addition, the consumer goods, electronics, chemicals, machinery, steel, construction, textiles, energy, and mining industries are focused on adopting advanced manufacturing technologies to remain competitive.

Currently, 36% of Türkiye's manufacturing exports consist of medium-tech products, and 3% consist of high-tech products. Türkiye aims to increase the former to 44% and the latter to nearly 6% by 2023.<sup>1</sup> The government of Türkiye generally supports technology initiatives and major procurements, creating new opportunities for international technology companies. Over the next decade, Türkiye is expected to invest between US\$1 to US\$1.5 billion annually to integrate industry 4.0 solutions (referring to the fourth industrial revolution and the digital transformation across manufacturing industries) into the manufacturing process.<sup>1</sup>

Further investment is needed to upgrade Türkiye's technological infrastructure, including funding for fixed and mobile broadband services and fibre optics. Türkiye's path towards digitalisation will also require prioritising Science, Technology, Engineering and Math (STEM) skills in education. If Türkiye fully adapts the Industry 4.0 concept, it could save \$10 billion yearly in current manufacturing costs based on an estimated 4-7% increase in productivity.



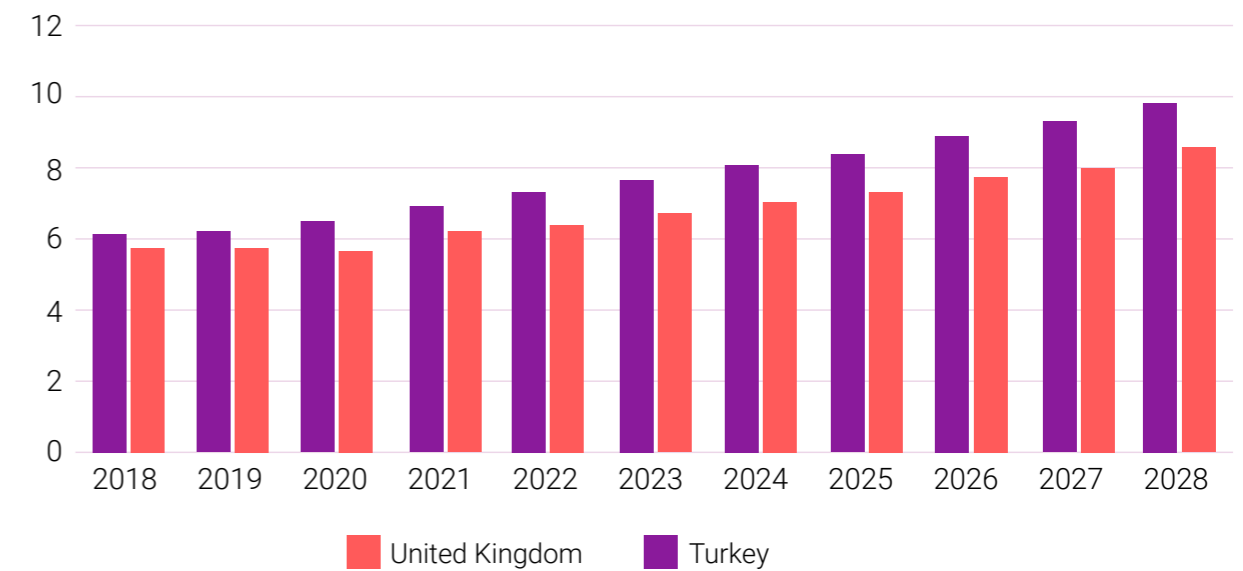
### The Automotive Industry in Türkiye

Türkiye boasts a well-established automotive industry, with many international automakers having production facilities in the country. It is currently one of the leading automotive producers in Europe. While the UK also has a significant automotive industry, Türkiye's lower production costs and strategic location make it a preferred destination for automotive manufacturing.

<sup>1</sup> <https://www.trade.gov/country-commercial-guides/turkey-advanced-manufacturing>



### Number of Automotive product enterprises in thousands



### Number of Automotive Products enterprises in thousands<sup>2</sup>

In 2019, the Ministry of Science, Industry and Technology announced Türkiye’s 2023 Industry and Technology Strategy detailing incentives for R&D and digital transformation of industrial enterprises. Türkiye plans to invest heavily in over 300 product groups in the machinery, semiconductor, aerospace, defence, transportation technology, software, electronics, chemistry, and pharmaceutical industries.

The Ministry will provide incentives for the development of new technologies involving artificial intelligence, 5G, big data and data analytics, IoT, blockchain, robotics and autonomy, UAVs, biotechnology, nanotechnology, cybersecurity, additive manufacturing, quantum computing, ag-tech, and energy technologies.

The Turkish government plans to establish Digital Transformation Centres piloting new technologies within organised industrial zones and technology development zones (Technoparks). MEXT, located in Istanbul, is Türkiye’s largest digital transformation centre, showcasing over thirty new technologies. Due to Türkiye’s Customs Union with the European Union, Türkiye has access to EU Horizon Europe/EU Industry 4.0 funds. These funds provide US\$0.5 - US\$2.5 million in support for private sector projects in various Industry 4.0 categories.

<sup>2</sup> Statista Market Insights 09/01/2023, Data shown reflects market impacts of the Russia-Ukraine war.

## Leading Sub-Sectors in advanced manufacturing in Türkiye:

### Innovative materials/technical textiles:

Innovative materials and technical textiles are widely used in several industries including aerospace, agriculture, construction, infrastructure, medical, energy, transportation, marine, and defense. Türkiye's total imports, which include composites, in this category amount to approximately \$2.5 billion. The market is expected to experience an annual growth rate between 4-7 percent.

**Additive manufacturing:** Additive manufacturing, also known as 3D printing, has been adopted by various industries in Türkiye since 2014, including automotive, aerospace and defense, household appliances, jewelry, and medical/dental. Small and medium-sized enterprises (SMEs) primarily use additive manufacturing for the molding process and often outsource this service. As of 2017, Türkiye's usage of additive manufacturing accounts for 1.2% of the global total. Over 480 3D printers, mostly polymer-based, are currently used in manufacturing. There is an increasing demand for advanced 3D printers, CAD and CAM programs, advanced printing materials, including biomaterials, and large-scale additive production capabilities.

**Industrial Automation:** The industrial automation market in Türkiye, as per the Industrial Automation Association (ENOSAD), was worth \$1.5 billion in 2016, with an annual growth rate of over 12%. It is projected to grow and reach \$3 billion in the next five years.

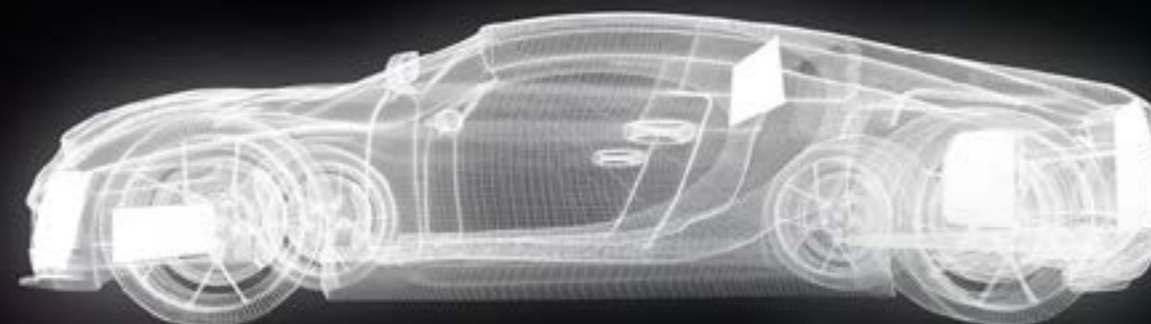
**IOT/Big Data and Analytics:** Some of the solutions used by Turkish companies include:

- Supply chain and warehouse management processes – real-time tracking of demand, order fulfillment, manufacturing flow, returns, etc.
- Production lines – real-time control of performance, product durability and safety
- Predictive maintenance – real-time monitoring of industrial manufacturing devices allowing companies to predict when maintenance is required

**Robotics:** There are 12,500 robotics equipments in Türkiye, with about half in the automotive industry. According to 2018 statistics, countries with advanced robotics in manufacturing use 300 robots per 10,000 workers. This number is just 19 in Türkiye, leaving significant potential growth opportunities for robotics in manufacturing industries.

**Augmented and virtual reality:** Although the use of AR and VR-based systems in manufacturing in Türkiye is still in its early stages, there is a significant interest in the market to adopt these technologies. Several leading companies in the aviation, defense, automotive, electronics, durable goods, and textile industries use AR and/or VR to select parts in their respective warehouses, transmit repair instructions over mobile devices, simulate products and production processes, and train workers.<sup>3</sup>

Following EU Exit, the UK signed a trade agreement with Türkiye.<sup>4</sup> The agreement includes provisions on trade in goods – including provisions on preferential tariffs, tariff rate quotas, rules of origin and sanitary and phytosanitary measures, customs and trade facilitation, intellectual property, government procurement, technical barriers to trade, competition, trade remedies and dispute settlement.



<sup>3</sup> <https://www.export.gov/apex/article2?id=Turkey-Advanced-Manufacturing>

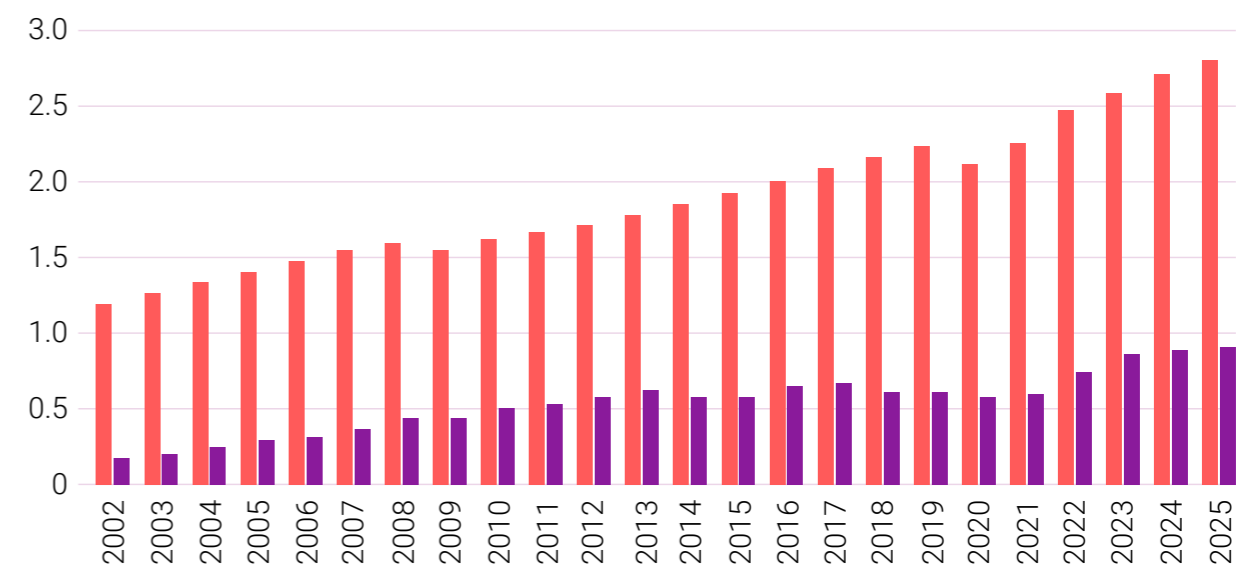
<sup>4</sup> <https://www.gov.uk/government/publications/ukturkey-free-trade-agreement-cs-turkey-no12021>



## 2.1 Existing Science & Innovation Landscape

Türkiye has experienced rapid economic growth since becoming a member of the G20. It has tripled its GDP from 2002 to 2018, making it the 20th largest nominal GDP and 11th largest GDP by purchasing power parity.

Gross Domestic Product (GDP)



Türkiye versus UK GDP between 2002 and 2025<sup>5</sup>

<sup>5</sup> Graph reference: Statista Market Insights 08/01/2023 Based on data from IMF, World Bank, UN and Eurostat.)



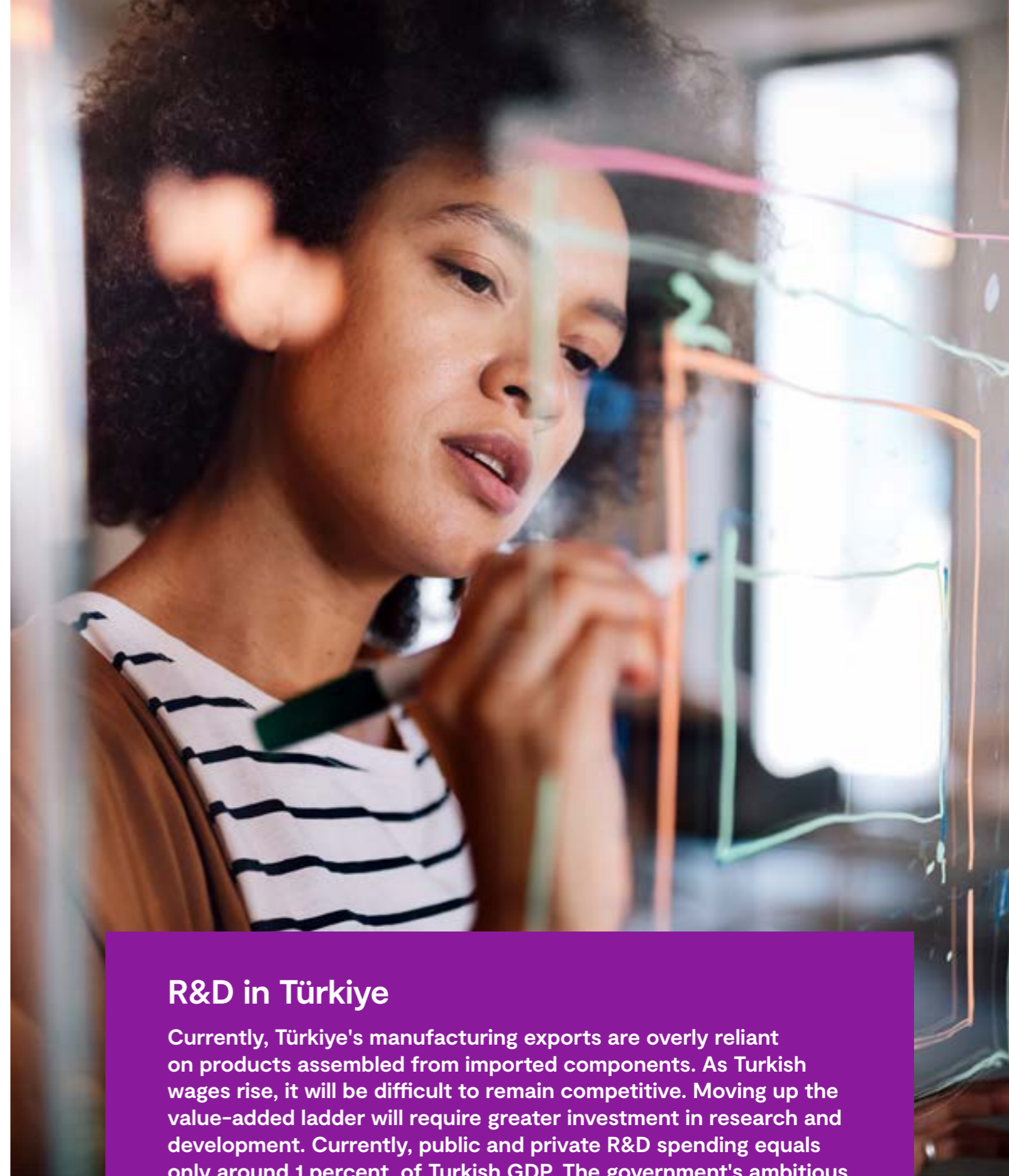
To advance their economy, the Turkish government established the Ministry of Industry and Technology in 2018 and significant investments in research and development have been made. Türkiye's Expenditure on R&D (GERD) percentage is favourable compared to other emerging economies such as India, Mexico, and Indonesia.

Türkiye has experienced growth in its intellectual property and scientific research sectors. Patent applications increased by 176% between 2009-2018 and the number of scientific journal articles rose by 30% between 2010-2018. The number of researchers per capita has also nearly doubled since 2007.<sup>6</sup>

In 2019, Turkish businesses invested USD16 million in research and development, which accounted for 64.2% of their total investment. This highlights their commitment towards achieving growth and competitiveness.

Türkiye has set a target to increase its R&D investment to 1.8% of GDP by 2023, Türkiye the aim of promoting two-thirds of research activities by the business sector.

The Scientific and Technological Research Council of Türkiye (TÜBİTAK), an affiliated institution of the Ministry of Science, Industry and Technology is driving Türkiye's science and innovation growth. Through several strategic initiatives such as funding & investment in priority technology areas, innovation & entrepreneurship support schemes, special incentive packages, and investment in technology zones and clusters with tax advantages, Türkiye is seeking to advance in the global innovation index.



## R&D in Türkiye

Currently, Türkiye's manufacturing exports are overly reliant on products assembled from imported components. As Turkish wages rise, it will be difficult to remain competitive. Moving up the value-added ladder will require greater investment in research and development. Currently, public and private R&D spending equals only around 1 percent of Turkish GDP. The government's ambitious goal is to increase that to 3 percent of GDP by 2023.<sup>7</sup>

<sup>6</sup> <https://www.gov.uk/government/publications/uk-science-and-innovation-network-country-snapshot-turkey>

<sup>7</sup> <https://www.bcg.com/publications/2013/globalization-growth-burak-tansan-snapshot-turkey>

## 2.2 S&I Collaboration between the UK and Türkiye

The UK-Türkiye scientific collaboration is ranked 20th in the world in terms of co-authored publications - 38,425 joint publications in monographs and journals were co-authored by UK and Turkish researchers from 2008 - 2018.<sup>8</sup>

As per SciVal data from 2018, the primary areas of UK-Türkiye publications have been medicine (19%), engineering (11%), computer science (7%), physics and astronomy (7%) and materials science (6%).



The UK is the fifth-highest R&I collaboration project partner country with Türkiye, having established a total of 3,560 collaboration links via Horizon 2020 and Horizon Europe programmes by 2022. Under the Framework Programme, Türkiye Innovation Performance of a Moderate Innovator, according to the European Innovation Scoreboard 2019.



<sup>8</sup> <https://www.gov.uk/government/publications/uk-science-and-innovation-network-country-snapshot-turkey>

## 03. Overview of Turkish Institutes, Technoparks, Technology Centres & Companies Visited

During the Global Expert Mission week, the delegation had the opportunity to meet with some of the leading innovators in the field of Advanced Manufacturing.

Based on their extensive involvement in international collaboration, these stakeholders were carefully selected as future-looking innovative organisations in materials and manufacturing, with a focus on being Net Zero and resource-efficient, resilient, responsive, technologically advanced and digital.

The delegation engaged in detailed discussions with the innovators, exploring the latest trends and cutting-edge technologies being developed in the industry. They also had the chance to witness some of these technologies first-hand, gaining valuable insights into their potential applications and impact.

The Overviews of the key Turkish organisations engaged during the Global Expert Mission are as follows:

### 3.1 TÜBİTAK

TÜBİTAK<sup>9</sup> (The Scientific and Technological Research Council Türkiye) is the leading organisation for the management and funding of research in Türkiye. It is also the principal advisory agency to the Turkish Government on national science, technology, and innovation activities internationally regarding bilateral and multilateral scientific and technological cooperation and research coordination. The organisation has ongoing bilateral associations with 92 institutions from 65 countries.

TÜBİTAK annually launches calls for proposals for academia, industry, and other sectors, also providing national coordination of EU Framework Programmes and is involved with both Horizon Europe and Eureka New Product Development programmes.

<sup>9</sup> For more details see Annex 2 - extract from TÜBİTAK organisation presentation slides.

## 3.2 Companies

### Karsan Factory & Technology Centre

Karsan Otomotiv Sanayii ve Tic. A.Ş is a leading international OEM designer and commercial and public transportation vehicle producer.

In recent years, the company has made major strategic R&D manpower and capital investments into innovations and advanced technologies for developing and producing Karsan branded electric and hydrogen-powered buses and autonomous vehicles. The company's strategic objective is to continue growing by focusing on new technologies to enable them to globally offer clean energy 'smart city' CAV solutions to meet the public transport needs of towns and cities looking to reduce urban area emissions.

Karsan Factory & Technology Centre is highly interested in collaboration in Electric vehicles, hydrogen, autonomous and connected vehicle R&I and the UK supply chain.

### Coşkunöz Holding Company & Education Foundation

Coşkunöz Holding is an international business made up of 13 manufacturing companies and 2,500 employees. The Group has extensive expertise and capabilities in materials, metal forming, welding/joining, design/reverse engineering, R&D, and informatics. Coşkunöz Holding has extensive production facilities and materials expertise in the traditional metal cold forming, hot stamping and joining/ welding technologies (laser/ hybrid MIG/MAG laser-arc/ spot/ friction stir welding), primarily used for fabricating steel, aluminium, and titanium components for OEM automotive, defence and aerospace customers.

Coşkunöz Holding Company & Education Foundation would be interested in expanding on existing UK R&I links and new links with UK HVMC. They are also very interested in future low-cost formed/additive manufacturing parts partners.

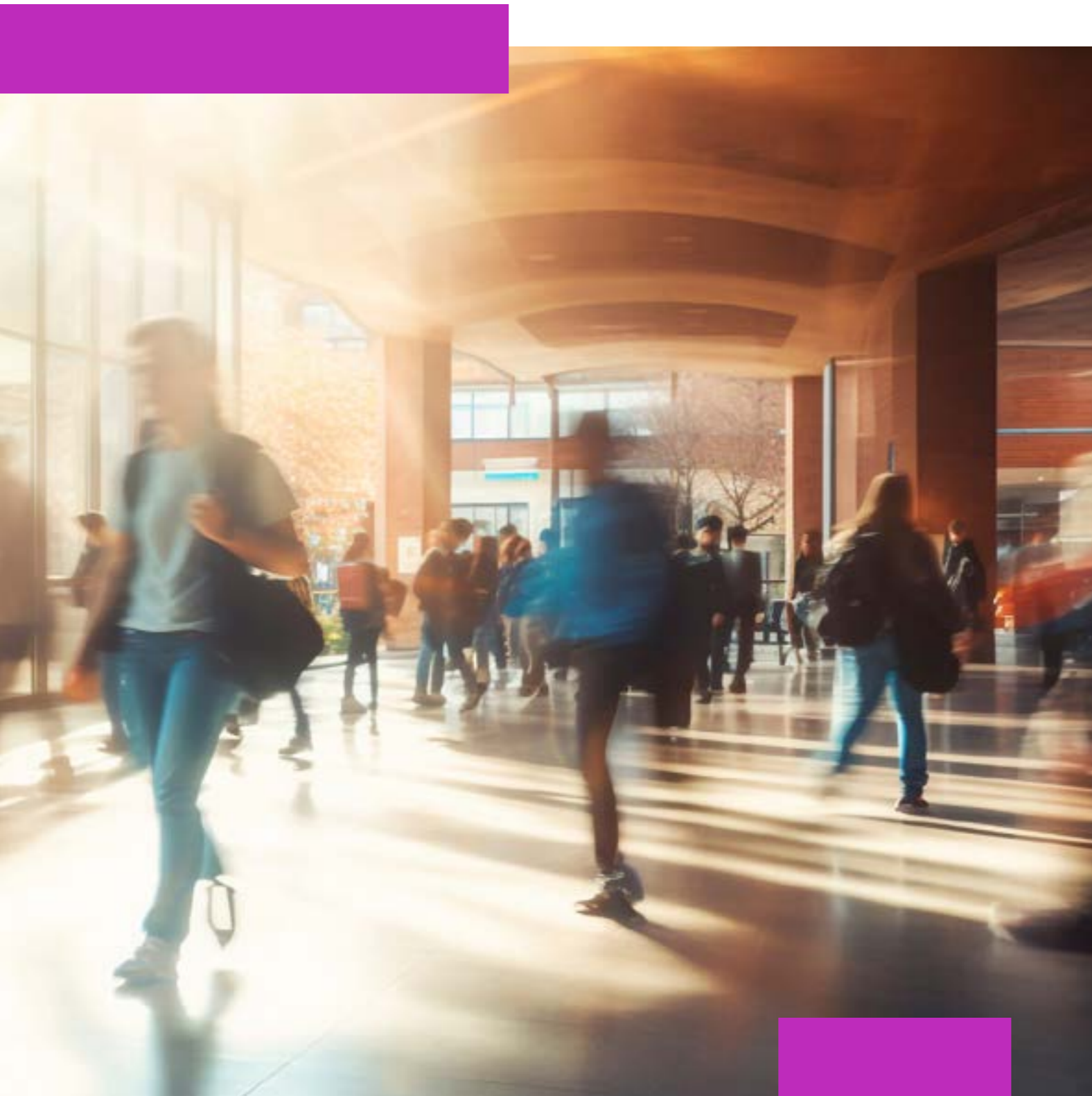
### Thread in Motion – IoT Smart glove

Established in 2017, the hi-tech start-up has successfully developed and launched a range of highly innovative Internet of Things (IoT) technology hand wearable 'real time' data gathering monitoring and mapping devices for the complete product supply chain. This innovative IoT technology has the scope to provide tangible benefits for both Industry 4.0 and the envisaged 'futuristic Industry 5.0 and Society 5.0 human-centric, sustainable, and resilient manufacturing system.'<sup>10</sup>

### Entekno Materials

Entekno Corp. specialises in developing advanced materials and nano-based additives that improve the properties of a variety of products. These materials protect against UV sunlight, ESD, and bacterial growth, while also being environmentally friendly. The company works closely with universities and industrial partners and is currently seeking partners for a new project focused on increasing battery capacity for electric vehicles. Entekno Materials is potentially interested in R&I collaborations to develop new ESD conductive polymers and to increase battery storage capacity. The company is actively seeking R&D partnerships with both UK academia and industry in order to advance the development of new, cutting-edge material additive technologies.





### 3.3 Universities, R&D, and Innovation/Technology Centres

#### Sabancı University, Tuzla, Istanbul

The extensive campus of Sabancı University (SU), established in 1996, is a leading technical research university in Türkiye for advanced materials and manufacturing technologies. SU has three faculties and eight research centres, with ~437 faculty members and 280 active projects in 2022.

- **The Faculty of Engineering and Natural Sciences** -The Materials Science and Nanoengineering Program presented included current TRL1-3 projects focused on the design and synthesis of polymeric nanostructures; magnetic resonance; materials for hydrogen gas and electric/clean energy conversion, harvesting and storage applications; sustainable materials and recycling; ceramics; composites; nano-engineered composites; advanced materials for environmental applications. SU is interested in R&I collaboration projects on ceramics; fuel cells; magnetic resonance; energy storage; recycling & sustainable plastics; and nano composite materials.
- **The Manufacturing & Research Laboratory (MRL)** - specialises in research into all aspects of CNC tooling and processes related to machining materials. Research topics more recently covered have included: digital twin applications in machining; alternative cooling methods; multi-tasking and parallel machining applications; abrasive process modelling and new abrasive tool development.
- **Nanotechnology Research and Application Centre (SUNUM)** - SUNUM provides an interface for nanotechnology transfer research, primarily focused on finding industry sector solutions for: energy; life sciences; food and agriculture; water, waste, and the environment. SUNUM is keen in R&I collaboration projects on: biomedical 'Lab on a chip' sensors; lithium batteries; H<sub>2</sub>; fuel cells; energy harvesting systems.

### **Integrated Manufacturing Technologies Research and Application Centre (SU-IMC)**

– is an open innovation centre with an ecosystem of faculty academics, pre- and post-doctoral researchers, design and process engineers and incubation technology entrepreneurs. The centre is part of Sabanci University and is heavily focused on delivering Technology Readiness Levels (TRL) 7/8 industrial-scale advanced manufacturing and materials development. The SU-IMC site includes two innovation centres:

- **Composite Technologies Centre of Excellence (CTCE)** to provide a dedicated composites technology R&I and production facility. CETC works collaboratively between academics and industry partners on basic and applied research; innovation technology development from TRL 3; product development up to TRL 7/8 prototyping; resourcing, manufacturing processing and scale-up mass production.

- **Digital Advanced Manufacturing Innovation Centre (DMIC):** A 'virtual' R&D joint venture collaboration with the global TWI Innovation Network (TWIIN). DMIC focuses on novel technologies for data-driven digital manufacturing of metal and composite parts.

SUMIC is interested in possible TRL 4-7 HVMC UK-Türkiye collaboration projects focused on functional polymers; nano-reinforced thermoplastic composites; metal/polymer additive manufacturing and is looking at partners interested in progressing TRL3 advanced materials R&I projects up to TRL 7/8.



### **MEXT (MESS) Technology Centre, Istanbul**

MEXT is Türkiye's leading digital transformation and capabilities technology centre for manufacturers, set up by the Turkish Employers' Association of Metal Industries (MESS). MEXT is currently the largest digital capabilities, industrial transformation, and IoT/ Industry 4.0 competence development centre, supported by MESS, which is a World Economic Forum C4IR (Centre for the 4th Industrial Revolution) network member. The MEXT ecosystem has more than 30 globally recognised technology providers, universities, and institutions including a digital transformation collaboration with Microsoft Corp., and cooperation with US Silicon Valley-based PLUG AND PLAY, the world's largest innovation ecosystem and entrepreneurship platform for IoT, energy, materials, mobility, and logistics.



### 3.4 Technoparks (Technical Development Zones)

There are a number of established technical development zones (TDZ) currently operating in Türkiye, which provide an ecosystem for R&I activities and new technology start-ups.

#### **Teknopark Ankara**

Established in 2014, Teknopark Ankara is home to more than 350 select Turkish companies. These businesses comprise established manufacturers, engineering technology and service providers, and innovative start-ups focusing on high-tech solutions. The park has a strong affiliation with Ankara Yildirim Beyazit State University.

#### **Teknopark Istanbul**

Teknopark Istanbul TDZ is a non-profit organization that boasts an extensive ecosystem in 2022, featuring 55 international/multinational partner companies, 402 R&D companies, 8961 R&I development engineers, and more than 120 start-up companies in incubation cubes (refer to section 4.5 for more information). The resident companies focus on developing innovative new technologies, such as advanced materials and manufacturing, to be used in various industries, such as transportation, energy, defence, aerospace, marine, life sciences, biotech, and electronics.

#### **Bilişim Vadisi (Informatics Valley) TDZ**

Bilişim Vadisi TDZ, which started in 2019, is a platform for established private companies and innovative start-ups looking to develop and commercialise high-technology products. The focus of the interconnected Bilişim Vadisi ecosystem, which brings together R&D innovators, entrepreneurs, and investors, is on six key application areas: mobility; connectivity; cyber security; design; smart cities; gaming and digital animation.

### 3.5 Incubation Centres

#### **Technopark Istanbul Cube Incubation**

The Cube Incubation Center at Technopark Istanbul provides start-ups with workspace and laboratory access. It houses over 420 Turkish and graduate incubation companies, mainly focused on creating innovative and impactful deep technologies such as advanced materials, microwave, optical/mechatronic sensors, artificial intelligence, and cybersecurity.

#### **Incubation Business Centre (KIM) - Bilişim Vadisi (IT Valley)**

Bilişim Vadisi TDZ campuses include an Incubation Business Centre, to which a start-up company must apply to join and go through a three-stage evaluation process. Most incubation start-ups are focused on developing new technologies for the six key application areas of the Bilişim Vadisi TDZ (see section 4.5).

### 3.6 Technology Support/Start-up Private Financers

#### **TTGV**

Established in Istanbul in 1991, supports private sector R&D and innovation in Türkiye. Their current focus is on developing new materials and technologies to address climate change. They have launched the Climate Technologies Trailblazer Project for 2023-2028, which includes R&D, industry, entrepreneurship, and investment. See Annex 2 for more information.

#### **Startups.Watch**

Startups.Watch is a profit-based organization offering a web-based platform for members to access the latest business information and ecosystem intelligence for various industries in Türkiye. It focuses on innovative technology start-ups developing advanced manufacturing and disruptive/process improvement technologies such as IoT, Industry 4.0, AI, and robotics. It also provides solutions for sustainability and net-zero challenges.

#### **Diffusion Capital Partners (DCP)**

Based in Istanbul, is an independently managed deep technology transfer and seed-stage venture capital fund investment company. DCP invests in innovative science and technology-driven start-ups with potential for commercialization in various sectors, including life sciences, biotech, energy, and robotics.

#### **Venture Capital Investment Fund - Bilişim Vadisi (Informatics Valley) TDZ**

A new Venture Capital Investment Fund has been established by Bilişim Vadisi TDZ and partners with an initial capital of TL 300 million. The fund aims to invest in innovative Turkish start-ups specializing in non-military high technology products for six key areas, including mobility, connectivity, cyber security, design, smart cities, gaming, and digital animation.



## 04. Potential UK–Türkiye Collaboration Opportunities

### 4.1 Key Collaboration Opportunities

During the mission, companies and organisations showcased impressive facilities, expertise, and innovative product development capabilities.

the GEM team conducted a thorough analysis of the advanced manufacturing sector in both the UK and Türkiye. The team identified several key areas where the two countries could collaborate to achieve mutual benefits. These areas ranged from cutting-edge technologies and manufacturing processes to workforce development and training programs. In the subsequent meetings, the GEM team discussed each opportunity in detail, highlighting the synergies and potential benefits to organizations in both countries. The team also discussed the challenges that might arise and ways to overcome them. The goal of these discussions was to foster a better understanding of the potential collaboration opportunities and to lay the groundwork for future partnerships in the field of advanced manufacturing.

During the GEM, several potential areas of collaboration were identified, including:

#### **Opportunity in the development and low-cost production of new advanced and nano-based materials.**

Both the UK and Türkiye have expertise in advanced and nano-based materials. Potential partnership projects in the UK for research and innovation could involve sharing knowledge, and best practices, exploring new applications and joint research on developing:

- Reinforces Thermoplastic Composites, lightweight metallic and composite materials to enhance material performance, reduce weight, improve fuel efficiency in vehicles, and expand applications in aerospace, automotive, and other industries
- Ceramics for engines and electronics to increase engine efficiency, improve electronic devices, and expand market opportunities for ceramics.

- Functional polymers and new technologies using nanomaterials for the development of innovative products with improved material properties.
- Lower cost metal and polymer additive manufacturing to reduced production costs, faster prototyping, improved product customization, and expanded adoption of additive manufacturing technologies in various industries.
- Advanced environmental/sustainable materials to reduce environmental impact, enhance circular economy practices, and increase market competitiveness in industries that prioritise sustainability.



### **Supporting Türkiye transition to sustainability manufacturing**

Turkish manufacturers are becoming aware of the upcoming requirements and significant opportunities recycling and re-use represent. With the launch of sustainability programmes by TÜBİTAK and TTGV, there is an opportunity to collaborate with UK organisations to accelerate the development of sustainable materials and move towards a circular economy. The UK has existing EOL/ recycling policies and legislation which has helped to establish an effective national infrastructure for waste collection and material recovery and reuse. UK HVMC support and industry/academic organisation collaborations to accelerate the development of more sustainable material solutions could be very beneficial to all industry sectors in Türkiye by gaining access, via collaborations, to the respective sustainability expertise and best practices available in the UK.

### **Supporting the scaling up of new advanced technologies**

The collaboration between Turkish organisations and the UK could bring about a positive impact on the global community. Advanced technologies can be scaled up, and new materials, digitisation, and clean energies can be rapidly delivered. This partnership can pave the way for improved productivity and competitiveness, as well as net-zero solutions that benefit everyone.

The UK R&D universities, HVM Catapult, and leading UK companies doing R&I have facilities, knowledge and expertise that could be of benefit to help companies in Türkiye needing to undertake proof of concepts, pilot projects and feasibility studies.

The top three reasons highlighted that could be beneficial for UK companies to consider partnerships in Türkiye are:

- Access to well equipped, highly capable Turkish R&I facilities and technology centres.
- Development and production cost savings due to low labour costs and tax subsidies.
- Co-Development of new advanced technologies such as CCUS; clean/ hydrogen energy; IoT digitisation, data mapping, AI and machine learning, next-generation 'smart city', connected and autonomous vehicle (CAV) ecosystems. These new technologies could ultimately lead to future products and new markets for UK companies partnering with Turkish industries.

Exploring these collaboration areas could lead to an opportunity to gain benefit from each other's expertise and capabilities, leading to mutual growth and advancement in the engineering and manufacturing sectors.





## 4.2 Key Challenges to Collaboration Opportunities

The following challenges and areas of concern were identified by UK delegates regarding future UK-Türkiye collaboration opportunities. As part of the next steps, these will need further investigation on a case-by-case basis to establish if they can be mitigated or not in practice.

**The need for more sustainability is increasingly being recognised by Turkish companies and organisations.**

As part of evaluating potential opportunities, the area of understanding policies, regulations, certifications, and standards for key manufacturing industry sectors between Turkish and UK collaboration partners needs to be examined to ensure alignment. Currently, in Türkiye, recycling, end-of-life and sustainable materials is an areas needing much higher focus and commitment going forward.

**Identifying and securing long-term investment partners is a real challenge as it implies a very low return on investment.**

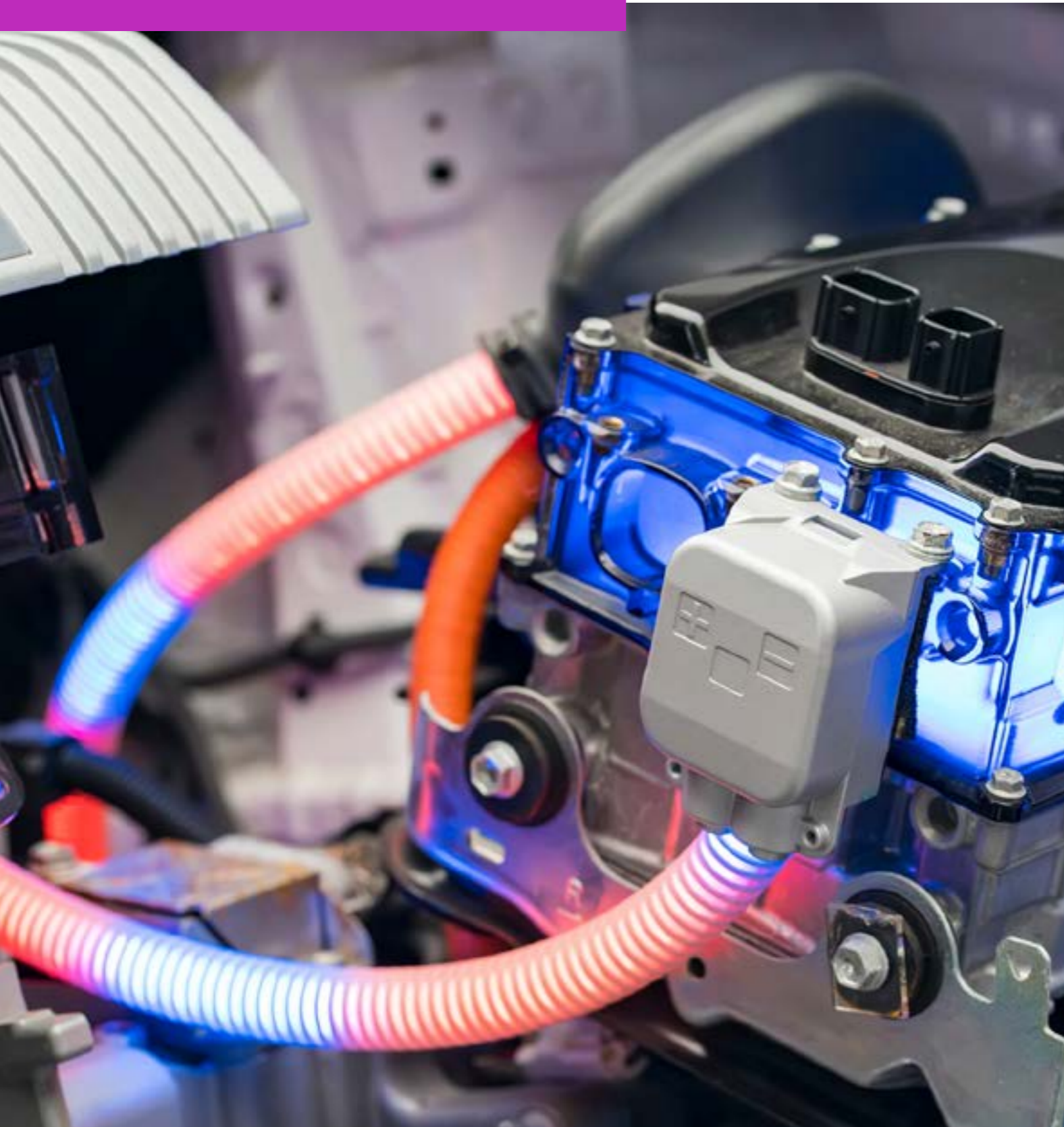
The cost and financing of research and innovation for new processes, products, and digitisation technologies, as well as the transition to more sustainable next-generation plant and production equipment, can be highly expensive in Türkiye due to high capital expenditure for new facilities and retrofitting.

**Finding the right project partners for collaboration is a major challenge for SMEs and smaller start-ups in Türkiye.**

This is due to limited internal expertise, resources, knowledge of the collaborative process, and the lack of international networking opportunities.

**Retaining key talent in Türkiye in a global market is a challenge.**

Türkiye needs more highly trained workforce with the right skills in existing and new technologies to support its growing manufacturing sectors. it is common to see highly educated individuals starting businesses or relocating outside of Türkiye, such as to the UK or other European countries.



## 05. Conclusions

The overall impression gained from the GEM is that Türkiye boasts a highly efficient ecosystem for research, innovation, product development, training, and education. This ecosystem comprises universities, advanced technology centres of excellence, and development zones and is open to entrepreneurial start-ups, SMEs, and larger companies. It is primarily financed by government tax incentives and funding via TÜBİTAK, as well as international Turkish private finance and venture capital companies.

Throughout the course of the mission, a number of exciting opportunities were identified to further strengthen the already established connections within Horizon Europe. One promising possibility that was explored was the potential implementation of brokerage events. Such events would provide a platform for different stakeholders to come together, exchange ideas, and foster collaboration.

In the field of research and industry, there exist numerous opportunities for collaboration. One of such opportunities is working together to develop new advanced and nano-based materials. From Composites, Ceramics, Polymers graphene, fuel cells and storage, These materials, which are have the potential to revolutionise the advanced materials and manufacturing sectors.

Another potential area of collaboration is the manufacture of high-quality goods at low costs. By combining the expertise of researchers and the resources of industries on IoT, AI, data mapping and Digitalisation, it is possible to develop and scale up cost-effective production methods that do not compromise on quality. This could lead to the creation of affordable products that are accessible to a broader range of consumers.

Lastly, utilising recycling and waste materials is another area where research and industry can collaborate. By finding innovative ways to reuse and repurpose waste materials, it is possible to reduce environmental pollution and create a more sustainable future. This approach is not only beneficial to the environment but can also result in cost savings for industries.

One area where Türkiye has great potential for growth is by expanding and promoting new advanced technologies, while also investing in the development of new skills and training programs. Türkiye has a great advantage in terms of cost, and the ecosystem for advanced manufacturing is thriving, with grants and venture capital available for innovative start-ups

In summary, by collaborating on these three areas, research and industry can achieve mutually beneficial outcomes that drive progress and innovation while promoting sustainability.

## 06. Annex 1

### List of Türkiye Expert Mission Participants, Companies, Bodies & Organisations

#### List of UK industry companies and bodies which sent delegates to the Türkiye GEM

BAE Systems plc  
 Baro Vehicles Limited (BARO)  
 High Value Manufacturing Catapult (HVMC)  
 Productive Machines  
 Rolls-Royce plc

#### List of Turkish Stakeholder Participant organisations: industrial & VC companies, industry bodies, Technoparks and R&D / Academic organisations met during the Türkiye GEM.

ACT Venture Partners	Sabancı University Integrated Advanced Manufacturing Centre of Excellence (SU-IMC)
Arçelik A.Ş	Sabancı University Nanotechnology Research and Application Centre (SUNUM)
Borçelik A.Ş	Teknopark Ankara A.Ş
Cozkunoz Holdings	Teknopark İstanbul A.Ş
Diffusion Capital Partners	TTGV (Technology Development Foundation of Türkiye)
Entekno Materials, part of ENTEKNO Industrial Technological and Nanomaterials Corp	Teknoloji Yatırım A.S (wholly owned VC subsidiary of TTGV)
FIGES A.Ş	TKG Automotive Tofaş Türk Otomobil Fabrikası A.Ş (Stellantis & Koç JV)
KALE HAVACILIK SANAYİ AŞ (Kale Aerospace, part of the Kale Group)	TUBITAK (Scientific and Technological Research Council of Türkiye)
Karsan Otomotiv Sanayii ve Tic. A.Ş	
MESS (Turkish Employers' Association of Metal Industries)	
MEXT Technology Centre	
Startups.watch	
Sabancı University Istanbul	



## 07. Annex 2

### Selected Turkish organisation slides

TÜBİTAK - Overview presentation slides

#### TÜBİTAK Research Centers and Institutes

Strategic R&D projects are being conducted towards meeting critical needs of our country.

Centers, Institutes and R&D Facilitating Units

**TÜBİTAK MAM**  
Marmara Research Center

**TÜBİTAK BİLGEM**  
Information and Information Security  
Advanced Technologies Research Center

~5.200 RESEARCH PERSONNEL

Centers, Institutes and R&D Facilitating Units: UZAY, SAGE, RUTE, UME, TÜSSİDE, Basic Sciences Research Institute, ULAKSİM, TÜRKAL National Observatory, BUTAL, Clean Change Project, Smart Agriculture and Food.

#### Joint Scientific and Technological Collaboration with UK Institutions

Scientific and technological collaboration involving United Kingdom institutions extends to 86 jointly funded projects and over 200 scholars and fellows supported with TÜBİTAK programmes (2014-2021)

+ 46 projects are jointly supported through the TÜBİTAK-British Council Institutional Links Program

+ 4 projects are supported through the new MoU for the British Council Research Environment Links Program

25 projects are jointly supported by the Industry-Academy Partnership Programme (IAPP) of the Royal Academy of Engineering

8 projects are supported in the TÜBİTAK-Research Councils UK (RCUK) Call

**EUREKA Program**  
TÜBİTAK-Innovate UK call (3 projects on energy, urbanization and smart cities and academia-industry cooperation)

Kâtip Çelebi-Newton Fund supported 16 scholars and 22 workshops; exchanges for extension towards innovation calls are ongoing

**UK Technology Conference 2020** held in İstanbul, Türkiye with Ministerial support

+ Over 200 scholars and fellows from the United Kingdom have been supported by TÜBİTAK programmes

#### TÜBİTAK TEYDEB Programmes

**PRIVATE SECTOR R&D AND INNOVATION PROJECTS**

Industrial Projects

1501	Industrial R&D	1507	SME RDI
1506	University-Industry Collaboration	1509	International-Industrial R&D Projects
1511	R&D and Innovation Projects	1515	Frontier R&D Laboratory
SAYEM	Industrial Innovation Networks	1707	ORDER-BASED R&D
1709	EUREKA EUROSTARS	1711	Artificial Intelligence

**DEVELOPING ENTREPRENEURSHIP AND INNOVATIVE CAPACITY**

Ecosystem

1503	R&D Project Brokerage	1513	Technology Transfer Offices
1514	Venture Capital Funding	1601	Capacity Building
1602	Patent Support	1702	Patent License

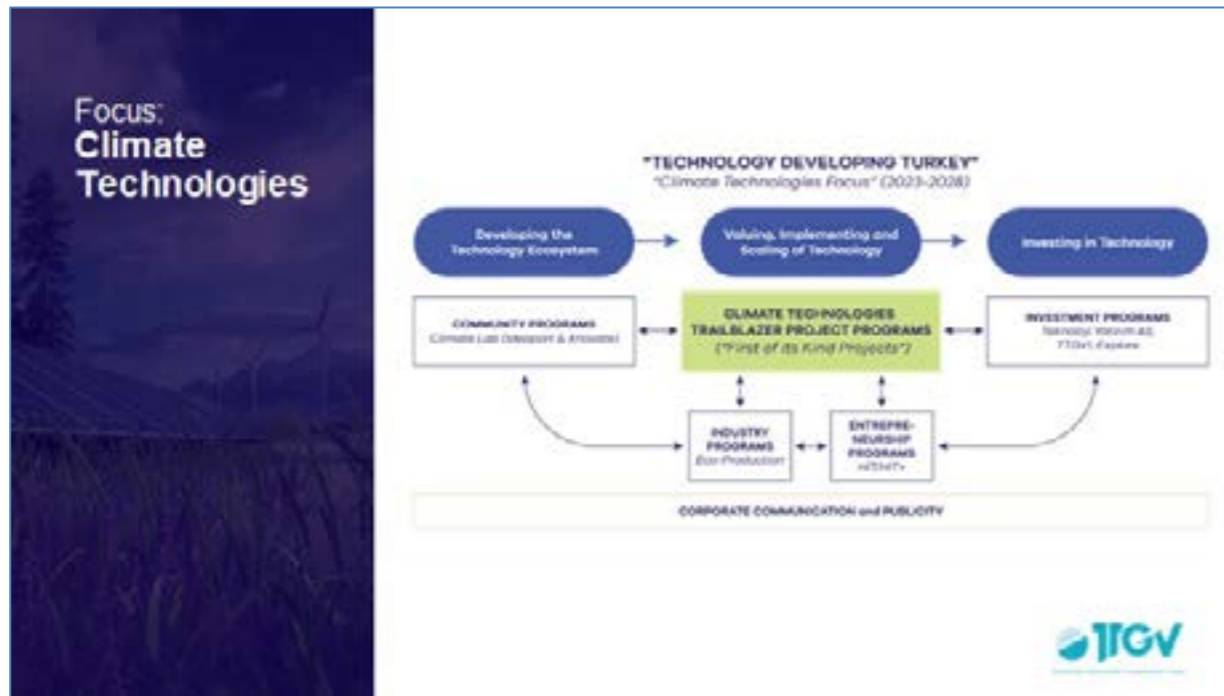
**ENTREPRENEURSHIP SUPPORT**

Individual Entrepreneur

**BiGG**

1512 Entrepreneurship Support Programme

TTGV 2023-2028 Climate Technologies Trailblazer Project programs sides



**FOCUS: Climate Technologies**

Mobility and Transportation	Energy	Food and Agriculture	Industry	Built Environment
Low carbon hydrogen production and storage	Renewable Energy Generation	Alternative Foods/Low GHG Proteins	Low GHG Iron, Steel, Aluminum	High Efficiency Space/Water Heating and Cooling
Fuel cell vehicles	Grid Managers	Vertical and Urban Farming (including aquaponics)	Low GHG Concrete and Alternatives for Construction (Cement)	Smart Management of Devices
Micro-mobility	Alternative Fuels	Low GHG/Energy Efficient Equipment	Energy/Resource Efficient Manufacturing Processes	Building Level (electricity and thermal) Storage
Low GHG Light and Heavy Duty Transport EVs and	Energy Storage (thermal or electricity)	Livestock methane capture	---	Low GHG Construction Processes
High Efficiency Vehicles	Carbon Capture, Uptake and Storage (CCUS)	---	---	---

**TTGV**



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Innovate UK drives productivity and economic growth by supporting businesses to develop and realise the potential of new ideas.

We connect businesses to the partners, customers and investors that can help them turn ideas into commercially successful products and services and business growth.

We fund business and research collaborations to accelerate innovation and drive business investment into R&D. Our support is available to businesses across all economic sectors, value chains and UK regions.

Innovate UK is part of UK Research and Innovation.

**For more information visit [ukri.org/councils/innovate-uk/](https://ukri.org/councils/innovate-uk/)**

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