2030

INDUSTRY AND TECHNOLOGY STRATEGY

REPUBLIC OF TÜRKİYE
MINISTRY OF INDUSTRY
AND TECHNOLOGY

#NATIONAL TECHNOLOGY INITIATIVE

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Republic of Türkiye
Ministry of Industry and Technology

The Directorate General for
Strategic Research and Productivity

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Over the past 22 years, through the projects we have launched, the reforms we have enacted, and the bold steps we have taken, we have elevated Türkiye to a position of influence on the global stage. We have continuously expanded upon our achievements across strategic sectors—most notably in development, technology, and the defense industry—adding new milestones to our progress. Today, the progress we have made across science, industry, technology, and innovation is being further consolidated in line with the vision of the "Century of Türkiye," as we steadily reinforce our aspiration for global leadership.

Indeed, we now proudly export our domestically developed and nationally owned technological products to 185 countries around the world. We are committed to carrying the momentum we have generated in the Defense Industry into other critical sectors in the near future, as we continue, with unity and resolve, to advance toward our goal of a "Great and Powerful Türkiye." Through strategies anchored in high-technology production, sustainable development, and digital transition, we are determined to position Türkiye as one of the principal actors in the emerging, techno-centric global order.

Among our foremost priorities is to ensure that our high-tech products serve not only our friends and allies, but also neighboring countries, in a manner that contributes to peace, stability, and collective security. In our civilizational tradition, knowledge and wisdom are regarded as a source of light—one that extends far beyond our borders, illuminating the wider region. It is our historic responsibility to project that light—which we will further strengthen during the Century of Türkiye—across our entire geography.

The 2030 Industry and Technology Strategy, formulated as a cornerstone of this overarching vision, represents a major step forward in advancing our goals of technological independence, economic progress, and sustainable growth, in alignment with our National Technology Initiative. We consider this Strategy to be one of our most essential roadmaps for ensuring that Türkiye remains a strong, respected, and influential country today, and secures its rightful place in the global future.

I extend my sincere congratulations to all those who contributed to the preparation of the 2030 Industry and Technology Strategy, and I hope that this document will serve as a source of enduring benefit for our country and our nation.

Recep Tayyip ERDOĞAN
President of the Republic of Türkiye

The global economy is undergoing a fundamental transformation, marked by a shift from liberal trade regimes toward protectionist policies and the pursuit of strategic autonomy. As the global balance of power is reshaped, trade wars, disruptions in supply chains, and energy crises are driving countries to strengthen self-reliance and establish more resilient infrastructures. In this era, which is defined by the reconfiguration of global alliances and cooperation frameworks, nations are prioritizing economic security and embracing development models designed to reduce external dependency.

Our historical experience has clearly demonstrated that there is no viable alternative to developing nationally-driven and original technologies, nor to cultivating innovative, high value-added, competitive, and sustainable production, if Türkiye is to achieve lasting development. Prior to the 2000s, a substantial portion of our industrial base remained confined to assembly-oriented production, preventing our country from securing a leading position in the global development race.

Under the leadership of our President Recep Tayyip Erdoğan, we have, over the past 22 years, forged a new trajectory for our nation's history and future. We have achieved transformative milestones that have elevated Türkiye to its rightful place on the world stage. We built, virtually from the ground up, a robust ecosystem for research, development, and innovation. With the development of organized industrial zones, an investor-friendly incentive framework, a qualified workforce, and strategic logistical networks, we have positioned Türkiye as a global production hub. We have delivered investment, employment, production, and exports to all 81 provinces of our nation.

And yet, we do not consider these accomplishments, which we proudly regard as the fruits of our National Technology Initiative, to be the final destination. For us, this is the time to consolidate domestic and national production capacity across all domains of technology, and to realize a Türkiye that leads in science, industry, and innovation.

We are fully aware that achieving our country's economic and technological sovereignty requires enduring strategies and unwavering collaboration among governmental agencies, the business world, and academia. The **2030 Industry and Technology Strategy,** prepared through the valuable contributions of our partners in the scientific, industrial, and technological spheres, is a manifestation of this unified vision.

Anchored in the vision of the **National Technology Initiative,** our Strategy Document is structured around five strategic pillars: **High Technology, Digital Economy, Green Transition, Global Integration,** and **Structural Transformation.** To deliver on these pillars, we have established **100 strategies** and **20 macro-level objectives**. Spanning a wide policy spectrum, from the HIT-30 High Technology Investment Program to the National Chip Consortium, from Mega Industrial Parks to the Local Development Move, we have outlined flagship programs and projects.

The 2030 Industry and Technology Strategy has been designed not only to advance Türkiye's national aspirations, but also to deliver reciprocal benefits at the regional and global levels, in line with our country's historical legacy and geopolitical responsibilities. Regional research networks, new trade corridors, and cross-border partnerships will open new frontiers in science, industry, and technology for our neighboring geographies.

I am confident that the actions we have envisioned in this Strategy, which is implemented together with our industrialists, entrepreneurs, scientists, researchers, workers, and youth, will serve as a catalyst in achieving our goals for the Century of Türkiye.

I extend my sincere hope that the 2030 Industry and Technology Strategy will bring enduring benefit to our nation, and I convey my gratitude to all stakeholders and colleagues whose dedication made its preparation possible.

Mehmet Fatih KACIR
Minister of Industry and Technology

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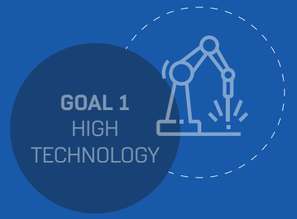


FLAGSHIP PROGRAMS AND PROJECTS

2030 INDUSTRY AND TECHNOLOGY STRATEGY

FIGURES

ABBREVIATIONS

EU	European Union
USA	United States of America
ADC	Antibody Drug Conjugates
AR	Augmented Reality
R&D	Research and Development
ASIC	Application-Specific Integrated Circuit
EGD	European Green Deal
BESS	Battery Energy Storage Systems
BGUS	National Strategy for Regional Development
BIPV	Building-Integrated Photovoltaic
ESP	Entrepreneurship Support Program
BİLGEM	Research Center for Advanced Technologies in Informatics and Information Security (TÜBİTAK)
RDF	Regional Development Fund
UN	United Nations
CIC	Communication Integrated Circuits
ACSP	Attraction Centers Support Program
CRMA	Critical Raw Materials Act
DeFi	Decentralized Finance
DNA	Deoxyribonucleic Acid
EBRD	European Bank for Reconstruction and Development
ERA	European Research Area
ESA	European Space Agency
MoENR	Ministry of Energy and Natural Resources
ETS	Emissions Trading System
eVTOL	Electric Vertical Take-off and Landing
FinTech	Financial Technologies
FPGA	Field-Programmable Gate Arrays
GAP	Southeastern Anatolia Project
EIS	Entrepreneur Information System

GPU	Graphics Processing Unit
GDP	Gross Domestic Product
HPC	High-Performance Computing
IIoT	Industrial Internet of Things
IoT	Internet of Things
ISRO	Indian Space Research Organisation
UAV	Unmanned Aerial Vehicle
İŞKUR	Turkish Employment Agency
JAXA	Japan Aerospace Exploration Agency
KAIST	Korea Advanced Institute of Science and Technology
SME	Small and Medium-Sized Enterprise
KOSGEB	Small and Medium Enterprises Development and Support Administration
CCUS	Carbon Capture, Utilization and Storage
MAM	Marmara Research Center (TÜBİTAK)
MENA	Middle East and North Africa
MIT	Massachusetts Institute of Technology
VQA	Vocational Qualifications Authority
NASA	National Aeronautics and Space Administration
NPP	Nuclear Power Plant
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
OPEC	Organization of the Petroleum Exporting Countries
OIZ	Organized Industrial Zone
OSBÜK	Supreme Organization of Organized Industrial Zones
PEM	Proton Exchange Membrane
PMIC	Power Management Integrated Circuit
PPP	Purchasing Power Parity
RDE	Real Driving Emissions
RNA	Ribonucleic Acid
SAİK	Industrialization Executive Committee
DG SRP	Directorate General for Strategic Research and Productivity
SAYEM	Industrial Innovation Network Mechanism

SCADA	Supervisory Control and Data Acquisition
UCAV	Armed Unmanned Aerial Vehicle
CBAM	Carbon Border Adjustment Mechanism
SMR	Small Modular Reactors
STAR	Research Intern Scholarship Program
MoIT	Ministry of Industry and Technology
TFP	Total Factor Productivity
TIDIP	Türkiye Industrial Decarbonization Investment Platform
TIF	Technology and Innovation Fund
TL	Turkish Lira
TNO	Netherlands Organisation for Applied Scientific Research
TRUBA	Turkish National Science e-Infrastructure
TSE	Turkish Standards Institution
TUA	Turkish Space Agency
TUM	Technical University of Munich
TÜBA	Turkish Academy of Sciences
TurkStat	Turkish Statistical Institute
TÜBİTAK	Scientific and Technological Research Council of Türkiye
TÜRK PATENT	Turkish Patent and Trademark Office
TÜSSİDE	Türkiye Institute of Industrial Management (TÜBİTAK)
TÜTEL	Integrated Circuit Design and Training Laboratory (TÜBİTAK)
FTE	Full-Time Equivalent
IA	Implementing Agency
ULAKBİM	National Academic Network and Information Center (TÜBİTAK)
NMI	National Metrology Institute (TÜBİTAK)
VR	Virtual Reality
WSTS	World Semiconductor Trade Statistics
YTAK	Advance Loan Against Investment Commitment
AI	Artificial Intelligence

EXECUTIVE SUMMARY

Formulated in alignment with the vision of the National Technology Initiative, the 2030 Industry and Technology Strategy sets forth Türkiye's ambition to achieve independence in industrial production and technology, with a view to positioning the country among the leading nations in the production and export of high-tech goods.

The world now stands on the brink of profound shifts in the global balance of economic, political, and military power. While the early 2000s were marked by optimism spurred by advances in information technologies, the expansion of global trade, and the rapid growth of financial markets, this outlook gave way to uncertainty following the 2008 financial crisis. The crisis revealed the dangers of deregulation and speculative activities, prompting countries to adopt stricter regulatory frameworks in pursuit of financial stability. Meanwhile, China has transformed from a haven of cheap labor into a global power in digital technologies, and Europe's centuries-old central role has begun to erode. On a global scale, income inequality has deepened, population movements have intensified, and concerns over the climate crisis have grown, undermining faith in globalization and free market principles. The COVID-19 pandemic and the Russia–Ukraine war triggered further crises in supply chains and energy security, compelling major economies such as the United States and the European Union to revisit their policies and reinforce their industrial and technological infrastructures in an effort to achieve strategic autonomy. In this context, protectionism and domestic production have gained prominence, bringing to the fore strategies that prioritize localizing production facilities, diversifying suppliers, and strengthening independence in strategic sectors.

Drawing on this backdrop of global transformation, the 2030 Industry and Technology Strategy outlines the necessary steps for Türkiye to attain industrial and technological independence. Rooted in the vision of the National Technology Initiative, which aims to bolster the country's domestic and national production capacity, ensure autonomy in strategic sectors, and establish leadership in critical technologies, the Strategy defines 20 macro-level objectives, 5 goals, and 100 strategies supported by flagship programs and projects. It ultimately aims to shape Türkiye's industrial and technological ecosystem into one that is innovation-driven, digitally empowered, environmentally sustainable, and capable of generating higher added value.

The Strategy has been structured around the imperative of enhancing domestic and national capabilities in designated high-tech domains, most notably in defense, artificial intelligence, semiconductors, pharmaceuticals, medical devices, mobility, and renewable energy technologies. Accordingly, the document sets ambitious targets: tripling the current value of high-tech exports to reach USD 30 billion and doubling medium-high-tech exports to reach USD 180 billion. These targets, which place technological independence at the center of economic growth, underscore the strategic necessity of expanding local production capacities in critical fields. To that end, flagship initiatives such as HIT 30 and the Technology Focused Industrial Move Program are among the key measures introduced to guide R&D efforts and channel investments into priority areas. In addition, the Strategy foresees the formation of multi-stakeholder national consortia—with public support—in strategic domains such as semiconductors, nuclear energy, biotechnology, and petrochemicals. One such initiative, the National Chip Consortium, seeks to establish the full semiconductor production value chain, including design, manufacturing, packaging, and testing, within Türkiye. These consortia,

which are expected to drive private sector investment in technology-intensive fields, will serve not only to advance R&D but also to scale up production infrastructure and expand investment capacity.

Türkiye's defense industry, having demonstrated remarkable success in recent years, has become a testament to the country's ability to develop original technologies and has significantly bolstered its global standing. To ensure continued momentum in this sector, intensified R&D activities and investment incentives will be directed toward critical areas such as unmanned aerial and underwater vehicles, rockets, and air defense systems. In the coming period, mass production of the National Combat Aircraft KAAN will begin, and the Steel Dome Project will integrate all air defense systems into a single network. Transferring the expertise gained in the defense sector to civilian industries is of strategic importance, as it will help disseminate technological progress and support national development goals. In this process, the principle of dual-use technology will be emphasized, fostering knowledge, skills, and technology sharing between the defense and civilian sectors and generating joint solutions to meet the needs of both.

In the Strategy's preparation process, artificial intelligence technologies have been addressed as a fundamental pillar of the R&D and innovation ecosystem. Measures have been planned with a view to both strengthening scientific capacity and supporting generative AI models, most notably through the development of a Large Language Model in Turkish. In order to reinforce the country's data processing and high-performance computing capabilities, priority will be given to the Artificial Intelligence Supercomputer Investment Program.

Technologies related to electric and autonomous vehicles, as well as flight control systems for aircraft capable of vertical takeoff and landing, have been identified as priorities in advancing sustainable mobility solutions. Türkiye also aims to become a regional hub for battery and energy storage technologies, for which targeted R&D and investment incentives will be introduced.

The Strategy likewise envisions increased support for biotechnological and genomic research, with a view to achieving a leap in domestic capabilities in the production of active ingredients, pharmaceuticals, and medical devices. Through the Biotechnology Production Program, research infrastructure will be strengthened via partnerships between TÜBİTAK, universities, and the Ministry of Health, while public procurement will be strategically leveraged to support the production of domestic biopharmaceuticals. Another key priority, in terms of both localization and global competitiveness, is the development of agricultural and food security technologies. In this regard, innovative approaches such as vertical farming systems, tech-driven food production, robotic agriculture, and biotechnological crop protection are expected to offer solutions that contribute to both sustainability and national self-sufficiency. Investments in nanotechnology and materials science will also yield substantial gains on the path to technological independence.

The Strategy further encompasses initiatives under the National Space Program aimed at strengthening Türkiye's position in the global space economy. The knowledge gained from the Turkish Astronaut and Science Mission, coupled with the technological expertise acquired through the launch of the country's first domestically produced communications satellite, TÜRKSAT 6A, will serve as a foundation for forthcoming missions—most notably the Lunar Mission. A Space Technology Development Zone will be established in Ankara to foster space and aviation research and

support the growth of the ecosystem. Furthermore, in an effort to commercialize the R&D and production capabilities developed in satellite technologies and contribute to national security, a National Satellite Company will be founded. This company will unify all public entities within the satellite ecosystem under a single structure, thereby enhancing coordination and enabling more efficient use of both human and infrastructure resources.

A key priority of the Strategy is the comprehensive restructuring and empowerment of the entrepreneurship ecosystem, with a particular focus on high technology. In line with this objective, the Strategy sets forth ambitious targets for 2030: raising the total valuation of Turcorns to a minimum of USD 100 billion and increasing the number of technology-based start-ups to 100,000. In order to create the financial foundation necessary to achieve these targets, it is envisaged that venture capital investments will be scaled up to USD 20 billion. This vision entails a sweeping transformation across all components of the entrepreneurial ecosystem. One of the pivotal measures in this regard is the planned redirection of individual pension funds towards technology ventures, which is expected to play a crucial role in strengthening the financial underpinnings of entrepreneurship. The public sector, for its part, will assume a strategic role as an anchor investor during this transformation, increasing its contributions to venture capital funds with a view to both attracting international capital and fostering confidence within the domestic start-up ecosystem. These efforts will not only provide entrepreneurs with robust financial support but also encourage the development of innovative business models, thereby extending the culture of entrepreneurship across a much broader segment of society. Through initiatives such as Terminal İstanbul, GO Entrepreneurship Offices, venture capital funds, and similar instruments, Türkiye aims to position itself as a global hub for technology entrepreneurship.

Another strategic focus of the 2030 Industry and Technology Strategy lies in reinforcing the national ecosystem for science, research and development, and innovation. This focus is rooted in the broader objective of enhancing Türkiye's domestic production capabilities in high-tech and critical sectors while eliminating foreign dependency. To this end, investments will be intensified in order to bring the production of scientific knowledge up to global standards and to ensure the sustainable development of R&D and innovation processes. In this context, national research infrastructures will be established in priority areas such as artificial intelligence, semiconductors, genetics, quantum technologies, and cybersecurity. Support mechanisms will be expanded for research fields prioritized by TÜBİTAK, ensuring that scientific capacity is strengthened in alignment with national strategic goals. A particularly ambitious target is articulated in the Strategy: for Türkiye to rank among the top ten countries globally in terms of scientific publication output in at least five of ten designated priority research fields. Complementing this goal, collaborative research networks—HEYSEM, CEZERÎ, ARF, and BÎRÛNÎ—will be established under TÜBİTAK's leadership in an effort to create synergy across key and priority technologies. These networks will facilitate the formation of interdisciplinary working groups and the launch of joint research projects by diversifying resources and opportunities for cooperation among public institutions, academia, and industry. In the same vein, public research institutes and universities will develop closer partnerships with the industrial sector in order to accelerate the transfer of critical research into commercial applications. Furthermore, new incentive and guidance mechanisms will be introduced to ensure the active engagement of young people in the science and research ecosystem. In parallel with efforts to attract globally competent researchers to Türkiye, the Reverse Brain Drain Program will serve to repatriate Turkish scientists, engineers, and technical experts who currently work abroad, bringing their expertise back into the national system.

Another essential component of the strategy involves elevating scientific collaboration to the international level. In this context, Türkiye will take the lead in establishing two regional frameworks—namely, the "Turkic States Research Area" and the "Islamic Countries Research Area"—designed to strengthen scientific partnerships across the region. These structures, to be supported through joint research funds and researcher mobility programs, are expected to enable Türkiye to assume a prominent leadership role in the global scientific landscape.

The overarching architecture of the 2030 Industry and Technology Strategy is founded on the principle of transitioning to high technology, and it has been formulated with a view to achieving three interlinked objectives: facilitating the shift to a digital economy, enabling the green transition of industry, and ensuring deeper, more competitive integration into the global economy. The Strategy's second goal, which is "advancing the digital economy," seeks to enhance Türkiye's digital infrastructure, accelerate the technological integration of enterprises, and strengthen the country's position in international markets through competitive, homegrown digital solutions. The third goal focuses on achieving a green industrial transition with the dual aim of improving environmental sustainability and reducing carbon emissions. Both pillars are designed to support the Strategy's long-term growth vision, while laying the foundation for a profound transformation in both technological and ecological spheres.

The transition to a digital economy entails not only the adoption of new technologies but also a fundamental shift in mindset and institutional culture. Digitalization stands as the cornerstone of high-quality production, cost efficiency, and productivity, and it demands a highly skilled workforce. Within the framework of this transition, particular emphasis will be placed on advancing Türkiye's fiber-optic and next-generation communications infrastructure, which will be prioritized in order to swiftly meet the digital transition needs of industrial facilities. Incentive schemes supporting the digitalization of businesses will be broadened, and their implementation will be tailored on a sector-by-sector basis in order to ensure maximum effectiveness. Strengthening domestic production capabilities in industrial robotics, additive manufacturing, and advanced production technologies is recognized as a critical step toward enhancing the digital maturity of the industrial sector. Accordingly, the Strategy defines a target of increasing the number of installed robots in manufacturing to 200,000 by the end of 2030, representing an approximate eightfold rise. Moreover, indigenous technologies will be introduced in strategic areas such as navigation systems, search engines, social media platforms, and messaging applications. In pursuit of technological sovereignty and with a view to reducing dependency on foreign infrastructure, the Regional Positioning and Timing System will be implemented. This system, designed as a national alternative to global platforms such as GPS, will provide high-precision positioning, navigation, and timing data through Türkiye's own satellite infrastructure. Managing the risks arising from the lack of domestic alternatives—and thus from increased technological dependency—while safeguarding national interests through homegrown solutions, stands as a strategic imperative.

Blockchain, decentralized finance (DeFi), and crypto asset technologies represent additional strategic domains that will play a vital role in enhancing Türkiye's competitiveness in the digital economy. In this context, the necessary legal and technical infrastructures will be established, with a view to positioning Türkiye as a global hub for fintech through the development of innovative digital finance solutions. The digitalization of the agriculture, services, and transportation sectors will ensure that the transformation to a digital economy extends beyond industry and reaches

all segments of society. Extensive R&D initiatives and targeted investment incentives will be introduced in an effort to strengthen the digital competencies of these sectors, thereby increasing their productivity and competitiveness.

Türkiye has adopted cloud computing as a strategic priority, aiming to bolster the competitiveness of businesses, particularly SMEs, by offering next-generation technology solutions, while at the same time expanding national capacity through large-scale data centers and international partnerships. Meanwhile, open-source software developed domestically will foster innovation through enhanced transparency and flexibility, thus contributing significantly to the country's digital transition journey. On another front, efforts will be intensified to establish a secure and sustainable national Internet of Things (IoT) ecosystem. Through the integration of IoT devices and wireless network technologies, high-speed data transmission and real-time monitoring capabilities will be strengthened. Digital transition, however, is not solely dependent on technological infrastructure; human capital remains at its core. Accordingly, digital skills training programs and lifelong learning opportunities will be scaled up in order to reach every segment of society. To support workforce adaptability, both the current and projected impacts of digitalization will be analyzed, and policy recommendations will be developed. Furthermore, to accelerate the digital transformation of enterprises, services such as digital maturity assessments, strategy development, and consultancy will be expanded and made more accessible across sectors.

The third strategic goal—the green transition of industry—places sustainability at its core, with a particular focus on reducing carbon emissions. To that end, regulations aligned with the European Green Deal will be enacted to lower the industrial carbon footprint and ensure compliance with the Carbon Border Adjustment Mechanism (CBAM). Support tools and access to international financing will be diversified and expanded in order to expedite the transition to a green and circular economy. Investments in Organized Industrial Zones (OIZs) and other planned industrial areas will be increased to minimize environmental impact. In addition, the adoption of energy-efficient technologies in industrial facilities will be encouraged, while the implementation of energy management systems will be made mandatory.

Renewable energy forms a cornerstone of the green transition agenda. Achieving full domestic production capacity in solar energy technologies is regarded as a key milestone. The local manufacturing of essential components for wind turbines, together with investments in offshore wind energy, will accelerate progress toward Türkiye's renewable energy targets. Simultaneously, in an effort to activate a green hydrogen ecosystem, R&D initiatives and investment incentives will be boosted in areas such as electrolyzers and fuel cells. To enhance energy supply security and reduce industrial energy costs, investments in nuclear energy will be stepped up, with industrial facilities given priority access to these resources. In this regard, domestic nuclear reactors will be developed, and a Nuclear Technopark will be established to build national capacity in nuclear technology. Recognizing nuclear energy, alongside renewables, as a strategic priority will significantly contribute to Türkiye's pursuit of energy independence.

Water efficiency in industry represents yet another essential dimension of the green transition. Greywater recycling systems and industrial practices that promote water conservation will be more widely adopted to reduce overall consumption. In key sectors such as chemicals, metals, and textiles, waste management systems will be modernized to support recycling and the production of secondary raw materials. These efforts will not only mitigate the environmental impact of industrial activity but also enhance resource efficiency, thereby supporting sustainable economic

growth. Importantly, the green transition is not merely about fulfilling international obligations; it is a long-term national commitment to safeguarding a cleaner, more sustainable Türkiye for future generations. As such, it also necessitates a broader societal transformation. Awareness-raising and educational programs will be implemented to foster greater environmental consciousness within the industrial sector. The expansion of green jobs will be supported by adapting current workflows to meet sustainability standards, thereby promoting more inclusive and sustainable growth across society.

In order to secure a competitive position in the global economy, it is imperative to enhance the resilience of supply chains and increase adaptability in the face of emerging risks in international trade. In this respect, Türkiye will pursue mechanisms aimed at strengthening resistance to disruptions in global value chains, while also diversifying its export markets and resource bases. In high-performing export sectors such as motor vehicles, machinery, and electrical appliances, innovative strategies and sector-specific financing models will be designed. In parallel, mechanisms will be introduced to expand partnerships between local firms and international investors with a view to deepening Türkiye's integration into global value chains. At a macro level, country-specific trade strategies will be developed to reinforce Türkiye's role as a trade and production hub spanning the Middle East, North Africa, Europe, and Central Asia. These measures, which are shaped around the overarching goal of achieving USD 400 billion in manufacturing exports by 2030, will contribute decisively to strengthening Türkiye's position in global trade.

Access to and processing of critical raw materials are indispensable elements for achieving economic independence and sustainable growth. The identification of potential raw material deposits through satellite imaging, 3D subsurface mapping, and geophysical methods will enable more efficient utilization of Türkiye's natural resources. At the same time, investments in recycling and advanced processing technologies will allow resources to be used in accordance with the principles of environmental sustainability. In this context, international alliances will also be established to ensure the secure supply and processing of critical raw materials.

Digitalization offers significant opportunities to enhance efficiency in logistics and supply chain processes. Digital customs systems, e-commerce infrastructure, and blockchain-based logistics platforms are set to be developed in an effort to expedite export procedures. Ensuring access to these infrastructures—particularly for SMEs—will bolster the global competitiveness of many traditional sectors. The modernization of logistics infrastructure and innovative solutions such as intermodal transport will further strengthen the links between Türkiye's manufacturing industry and international markets.

Strategic brand development and global marketing initiatives will be promoted with a view to enhancing the international recognition of local products and increasing the global visibility of Turkish brands. Promotional campaigns and selective incentive mechanisms will be launched to attract foreign investors, especially in strategic sectors such as semiconductors, electric vehicles, and petrochemicals. To tap into the significant investment potential in the petrochemical sector, the Ceyhan Petrochemical Industrial Zone, covering approximately 30 million square meters and featuring its own port, will be established and transformed into a globally significant petrochemical hub.

Within the framework of the 2030 Industry and Technology Strategy, efforts will be intensified to establish new trade corridors that reinforce Türkiye's geopolitical advantage and historical mission. Development and trade corridors centered

around Al-Faw in Basra and Zangezur in the Caspian region will enhance connectivity among Asia, the Middle East, and Europe. Similarly, Türkiye aims to assume a leadership role by sharing its industrialization experience—particularly with newly restructuring countries in the Turkic world, the Middle East, and Africa—in an effort to strengthen and expand their production and research ecosystems and to promote prosperity across neighboring geographies. Operationalizing the Science, Technology, Innovation, Industry, and Investment (STI^3) Diplomacy will boost Türkiye's influence in science and technology diplomacy, while integrating research infrastructures with EU institutions and programs will add an international dimension to the country's scientific capacity.

In lieu of piecemeal or incremental progress, the 2030 Industry and Technology Strategy is centered around a comprehensive transformation in the fields of industry and technology. One of its foremost priorities is to expand industrial zones in a planned and goal-oriented manner. At the same time, it seeks to implement measures that will rapidly advance industrial enterprises—particularly SMEs—in key areas such as productivity, production capacity, access to skilled labor and finance, quality, scale, and institutionalization. All these measures and priorities have been defined in line with the vision of the National Technology Initiative, with a view to making the industrial and technological ecosystem more inclusive and ensuring that prosperity is shared across all segments of society.

The National Master Plan for Industrial Areas, currently in preparation, is designed to create new industrial areas and expand existing ones. These efforts will not only strengthen industrial infrastructure but also provide broader operational space for the economy's leading sectors. In particular, the relocation of industrial facilities from regions at high risk of earthquakes and other natural disasters to safer zones will play a critical role in this transformation. The creation of production and employment corridors to facilitate the concentration of industrial enterprises in secure areas is another step toward bolstering economic resilience. In order to ensure more effective operation of industrial zones—especially Organized Industrial Zones (OIZs)—logistics infrastructures will be upgraded. Within this scope, improving rail and port connections will enable industrial products to reach markets more quickly and at lower cost. In addition, alternative financing mechanisms will be introduced to encourage private sector investment in the development of industrial zone infrastructure, playing a vital role in enhancing the logistics capabilities of OIZs. The Mega Industrial Parks Project, to be implemented under the National Master Plan for Industrial Areas, envisions the establishment of fully integrated industrial cities. These multi-functional, integrated industrial cities will feature logistics infrastructure with access to ports, railways, and airports; foster industrial symbiosis; support green transition; and house technology hubs—such as data centers, incubation centers, R&D facilities, technology development zones, and innovation centers—with business centers, residential areas, and education and social service facilities.

In an effort to diagnose and address productivity issues in industrial enterprises, analytical assessment systems will be developed at both sectoral and firm-specific levels. These systems will leverage field data to support more effective policymaking. Expanding the capacity of Model Factories and boosting their role as productivity interfaces represent another strategic objective of the Document.

The Local Development Move introduces a new vision and dimension to regional development, emerging as a key tool to prevent the over-concentration of industrial investment in specific areas and to ensure more equitable distribution of prosperity nationwide. Under this initiative, each province will identify a limited number of high-impact investment

areas capable of accelerating provincial development. These will be supported through periodic calls. Special support mechanisms will also be introduced, under the coordination of the Ministry of Industry and Technology and through development agencies and regional development administrations, to encourage industrial investment in high-potential regions.

The financing of industry is among the strategic priorities outlined in this Document. Achieving the transformations envisioned in the Strategy and directing investment toward critical technologies and strategic sectors will require a financing approach specifically tailored to the industrial domain, departing from conventional banking practices. In this regard, priority will be given to project-based financing, with a view to establishing a stronger and more functional link between the banking and finance sectors and the industrial ecosystem. Fintech-based financial models will be expanded to improve SMEs' access to finance. Dedicated mentoring pools and accelerator programs will be launched to support innovative business ideas—particularly those led by women and young entrepreneurs—and grants will be provided to facilitate prototype development.

With a view to enabling enterprises to benefit from economies of scale, the 2030 Industry and Technology Strategy identifies increasing the average enterprise size from 10.94 to 12.5 employees as a key priority. To this end, KOSGEB will implement the Capacity Development Support Program. In addition, the Employment Protection Support Program will be launched to help safeguard jobs in labor-intensive sectors such as textiles, furniture, leather, and apparel. Complementary strategies outlined in the Document entails the development of modular industrial facility designs aligned with future growth needs and the integration of underperforming enterprises into sectoral transformation processes in order to ensure more effective use of national resources.

New measures will be introduced to encourage the participation of women, young people, and foreign workers in production processes. Skills matching in industry will be improved through vocational training and capacity-building initiatives, and education policies will be developed in response to labor market needs at the regional and sectoral levels. Industry and Technology Colleges, with a focus on science, technology, and vocational education, will be established to provide students with a robust theoretical foundation and hands-on learning opportunities.

The 2030 Industry and Technology Strategy envisions all stakeholders—public institutions, the private sector, academia, and civil society—fulfilling their respective responsibilities and working toward shared goals. Its success, in other words, the realization of its targets, will require the simultaneous implementation of a wide range of structural reforms. For instance, while traditional challenges such as productivity, scale, and access to finance—as addressed in Goal 5—are tackled, the demands of digitalization and decarbonization will also be met. Through these transformation practices, Türkiye will increase its domestic production capacity in high-tech sectors, deepen its integration into the global economy, and pursue bold initiatives to further reinforce its regional leadership. In this regard, the 2030 Industry and Technology Strategy—designed and formulated with a broad and multifaceted perspective—serves not merely as a roadmap, but as a nationwide call to action, requiring the active participation of all stakeholders in the realization of the National Technology Initiative vision.

Ministry of Industry and Technology

FORMULATION PROCESS

The 2030 Industry and Technology Strategy has been developed with a holistic perspective that seeks to enhance the welfare of all segments of society, going beyond a limited focus on specific sectors. In this context, it was considered essential for a strategy document centered on high technologies not to be confined solely to the manufacturing industry. Accordingly, the Strategy envisions placing a strong emphasis on technological advancement in other critical sectors such as energy, communications, agriculture, and health. Moreover, recognizing that the objectives defined in the document cannot be achieved without a highly qualified workforce equipped with new skills and competencies, it was considered imperative to include strategies targeting human capital—ranging from education and vocational development to research, innovation, and entrepreneurship capabilities—under each goal.

At the initial stage of the formulation process, a framework was designed around five main goals and corresponding focus areas, drawing on the scope and outcomes of the Industry and Technology Strategy 2023 published in 2019, as well as national priorities, strategic plans and programs, international policy documents, and global trends. This draft framework was shared with the central units of the Ministry of Industry and Technology and its affiliated and related organizations, and subsequently revised in light of the feedback received. The revised framework was then refined in greater detail through increasingly broad stakeholder engagement in the following stages.

The formulation of the 2030 Industry and Technology Strategy was guided by a foundational commitment to inclusion and participation. To this end, a range of tools were employed to solicit the views and assessments of various stakeholders. During this process, feedback was gathered from representatives of different sectors, academics, civil society organizations, and agencies, in an effort to take into account the expectations and needs of stakeholders. In addition to desk research, comprehensive interviews were conducted, and numerous meetings and workshops were organized. These efforts culminated in the emergence of a strategy document designed to contribute to building an inclusive and sustainable future for all.

To better understand the priorities of the Strategy's primary target group —firms— in the fields of industry and technology, an online survey was conducted. Distributed to firms of all sectors and sizes through the central units of the Ministry of Industry and Technology and its affiliated and related institutions, the survey received valid responses from 2,908 companies. Among the respondents, 50% were micro-enterprises, 37% were SMEs, and 13% were firms larger than the SME scale.

According to survey results, artificial intelligence and industrial robotics are expected to play a defining role in the digital transformation process. In line with this expectation, the availability of support tailored to digital transformation, the establishment of robust cybersecurity infrastructure, and alignment with international standards are regarded as critical priorities. In the context of the green transition, firms emphasized resource efficiency in industry, the adoption of a zero-waste approach, and the implementation of sustainable supply chain management practices. Solar energy technologies are expected to play a

key role in the near future, underscoring the need for awareness-raising, education, and capacity-building programs in this area. Regarding global integration and competitiveness, firms identified the following as priority issues: achieving compliance with international production standards; reducing dependencies on strategic raw materials, intermediate goods, and final products; and expanding into new export markets through international promotion and marketing efforts. With respect to the structural transformation and resilience of production, firms gave precedence to access to finance, workforce planning and employment policies, energy costs, the business and investment climate, and wage policies. Under the heading of high technology, firms underscored the importance of advanced materials technologies, next-generation battery technologies, and electric and hybrid vehicle technologies, while highlighting the need for target-oriented and selective incentive mechanisms.

In parallel with the development of the strategic framework, analytical reports were prepared to serve as the foundation for the macro-level objectives, goals, and strategies outlined in the document. In contrast to traditional situation analysis reports, these texts examined not only qualitative and quantitative indicators on the current state of affairs but also assessed short- and medium-term transformation trends at both national and global levels. In this context, the analyses presented answers to the questions of what, why, and how with respect to each subject area, while also offering policy recommendations outlining the course of action Türkiye should pursue in response to global transformation dynamics.

MACRO-LEVEL OBJECTIVES

	Indicator	Baseline Value	2030 Target
1	**Share of Manufacturing Industry in GDP** (%; 3-year moving average)	**21.25** (2021-2023)	**23** (2028-2030)
2	**Türkiye's Share in Global Manufacturing Value Added** (%)	**1.33** (2023)	**1.65**
3	**Manufacturing Industry Exports** (billion USD)	**247** (2024)	**400**
4	**Exports of Medium-to-High Technology Products** (billion USD)	**92.36** (2024)	**180**
5	**Exports of High-Technology Products** (billion USD)	**8.8** (2024)	**30**
6	**Export-to-Import Coverage Ratio in Manufacturing Industry** (%)	**88.02** (2024)	**105**
7	**Number of Manufacturing Exporters with Exports Exceeding USD 5 Billion**	**1** (2023)	**10**
8	**Value Added per Employee in Manufacturing Industry** (thousand USD)	**31.86** (2023)	**40**
9	**R&D Expenditure / GDP** (%; public and private sector; current prices)	**1.42** (2023)	**2.20**
10	**R&D Human Capital** (thousands; FTE)	**291** (2023)	**500**

	Indicator	Baseline Value	2030 Target
11	**Total Surface Area of Organized Industrial Zones and Industrial Zones** (thousand hectares)	**149.1** (2024)	**350**
12	**Average Size of Manufacturing Enterprises** (number of employees)	**10.94** (2023)	**12.5**
13	**Number of Enterprises Transitioning from SME to Large-Scale**	**253** (2023)	**1000**
14	**Venture Capital Investments** (billion USD)	**5** (2019-2024)	**20** (2025-2030)
15	**Number of Tech Startups** (thousands)	**11** (2024)	**100**
16	**Total Valuation of Turcorns** (billion USD)	**25**	**100**
17	**Share of Manufacturing Enterprises Engaged in Innovation Activities** (%)	**43.4** (2020-2022)	**60** (2028-2030)
18	**Number of Enterprises Commercializing Industrial Property Rights**[1]	**154** (2023)	**500**
19	**Number of Installed Robots in Manufacturing Industry** (thousands; cumulative)	**26.41** (2023)	**200**
20	**Number of Research Themes**[2] **in Which Türkiye Ranks Among the World's Top 10 by Publication Count**	-	**5**

[1]Number of Enterprises Benefiting from Tax Exemptions on Industrial Property Rights Through Production Based on a Patented or Utility Model-Certified Invention.
[2]Fields of Research: 1) Computer Sciences; 2) Environmental Sciences; 3) Energy; 4) Electrical and Electronic Engineering; 5) Pharmacology, Toxicology and Pharmacy; 6) Physics and Astronomy; 7) Chemistry; 8) Materials Science; 9) Mathematics; 10) Artificial Intelligence.

GOAL 1

Enhancing Domestic Production Capacity in High Technologies and Critical Areas, and Eliminating External Dependency

THE NATIONAL TECHNOLOGY INITIATIVE
DEFENSE INDUSTRY
MOBILITY SECTOR
ARTIFICIAL INTELLIGENCE
QUANTUM TECHNOLOGIES
SEMICONDUCTORS AND CHIP TECHNOLOGIES
SPACE ECONOMY
HEALTHCARE AND SMART LIVING TECHNOLOGIES
AGRICULTURAL TECHNOLOGIES
TECHNOLOGY-BASED ENTREPRENEURSHIP
SCIENCE, R&D, AND INNOVATION ECOSYSTEM
STRATEGIES

GOAL 1

Enhancing Domestic Production Capacity in High Technologies and Critical Areas, and Eliminating External Dependency

The National Technology Initiative

1. **The global economy is undergoing a paradigm shift.** The optimism that characterized the early 2000s—driven by advancements in information technologies, the expansion of global trade, and the growth of financial markets—has largely dissipated. The 2008 crisis laid bare the risks posed by deregulated financial systems and speculative practices. In the aftermath, many countries took steps to strengthen financial regulations in an effort to preserve economic stability. At the same time, China's transformation from a "cheap labor haven" into one of the world's foremost powers in digital technologies, the weakening of Europe's centuries-old central role in the global economy, as well as rising global and regional income inequality, population movements, and the climate crisis, have prompted a re-examination of globalization and free market principles.

2. **Crises such as the COVID-19 pandemic, which emerged in late 2019, and the Russia–Ukraine war further exposed the fragility and imbalances of the global system.** The pandemic triggered production halts that began in China and rapidly spread across other countries, disrupting the supply of raw materials and finished goods in multiple sectors worldwide. Sanctions imposed on Russia's energy exports following the Ukraine conflict caused energy prices to soar—particularly in Europe—and sparked concerns over supply security. The post-pandemic semiconductor crisis also shook key global sectors, most notably electronics and automotive. Moreover, in the first half of 2024, disruptions and delays in the Suez and Panama Canals exacerbated challenges to global trade flows, driving up maritime transport costs and rendering supply chains even more fragile.

3. **The mounting crises within global supply chains have prompted major economies—such as the United States and the European Union (EU)—to accelerate efforts aimed at reinforcing their industrial infrastructures.** These disruptions have revealed the extent to which the US and EU have lost self-sufficiency in many strategic sectors and become dependent, particularly in terms of raw material procurement, on other countries, most notably China. This realization, coupled with

China's emergence as the world's production hub, has brought the concept of strategic autonomy to the forefront. Many countries have thus begun to focus on strategies such as reshoring production facilities or diversifying their suppliers. These approaches, which are largely seen as decoupling strategies from China and Russia, have spurred new initiatives geared towards enhancing production and technological capabilities. In March 2020, the EU adopted an industry strategy centered around green transition, digital transition, and global integration. From 2021 onward, this strategy was revised to emphasize strategic autonomy and to reinforce the structure of the Single Market, leading to the development of new roadmaps and programs. A recent report, titled The Future of European Competitiveness: *A Competitiveness Strategy for Europe*, prepared by Mario Draghi and submitted to the European Commission in September 2024, seeks to define a general framework for these strategic autonomy-driven priorities. In the same vein, the US has launched the CHIPS and Science Act, particularly to promote domestic production in critical sectors such as semiconductors.

2023 Industry and Technology Strategy

Within the framework of the National Technology Initiative vision, the "2023 Industry and Technology Strategy", published by the Ministry of Industry and Technology in 2019, implemented comprehensive and multidimensional industry and technology policies aligned with Türkiye's 2023 goals.

The implementation period of the 2023 Strategy saw significant achievements: Togg delivered its first vehicle; the Technology Focused Industrial Move Program was launched; the National Space Program was published, and Türkiye's first crewed space mission was planned. Teknofest Aviation, Space and Technology Festivals were held, and new institutions such as the Türkiye Open Source Platform, the Artificial Intelligence Institute, and the Rail Transportation Technologies Institute were established. During this period, manufacturing industry exports exceeded USD 240 billion, and notable increases were recorded in both R&D personnel and the number of researchers.

4. **Through the vision of the National Technology Initiative, Türkiye clearly expressed its commitment to technological independence and strategic autonomy.** In the 21st century, Türkiye has undergone a far-reaching transformation in industry and technology. Guided by the principle of technological independence, the country laid the groundwork for a domestic and national production model. The political stability achieved in the 2000s not only made medium- and long-term reforms possible but also ensured predictability, which is an essential factor for both domestic and foreign investors. The

rapid expansion of industrial infrastructure, along with sustained incentives and support schemes for industry, served as key drivers of long-term economic growth. The industrial production index, which stood at an average of 30.95 in 2002, reached 107.54 in 2024.[1] This growth also reflected a diversification of the country's industrial output. Over these 22 years, the transformation of the R&D and innovation ecosystem, which is built almost from the ground up to foster higher-technology and higher value-added production, has been further articulated through the vision of the National Technology Initiative. In this context, Türkiye placed the connection between strategic autonomy and technological independence at the center of its economic policy framework well before many developed and developing countries began to acknowledge its significance.

5. **Designed to strengthen Türkiye's independence and enhance societal welfare by establishing a sustainable ecosystem in the fields of industry and technology, the 2030 Industry and Technology Strategy is predicated on the vision of the National Technology Initiative.** This vision highlights the role of achievements in the defense industry as a model for other

Technology Focused Industrial Move Program

The Technology Focused Industrial Move Program (Hamle - The Move) is a targeted R&D and investment support initiative implemented by the Ministry of Industry and Technology to boost high value-added production in Türkiye. Combining investment incentives with support from TÜBİTAK and KOSGEB under a single mechanism, the program aims to produce medium-high and high-tech products using domestic capabilities. The Move Program supports innovative and competitive investments through calls issued in product and technology areas selected according to current needs and technological developments. These investments are closely monitored until completion, benefit from tailored financial support, and undergo impact analysis.

TECHNOLOGY FOCUSED
INDUSTRIAL MOVE PROGRAM

To accelerate Türkiye's technology-driven development, the program will issue theme-based calls at regular intervals.

Application and evaluation processes are managed online through hamle.gov.tr while details of supported projects are shared with the public at yatirimharitasi.hamle.gov.tr

sectors and underscores the importance of developing critical technologies domestically. Its ultimate goal is to "secure Türkiye's economic and technological independence and increase its global competitiveness." Accordingly, the Strategy places the entire ecosystem that affects industry and technology at its core, including education, human resource planning, industrial zones, and research infrastructure.

6. **Launched in 2019, the Technology Focused Industrial Move Program ensures that industrial inputs are equipped with domestic and national capabilities and supports R&D initiatives in technologies that will shape Türkiye's future in strategic focus areas.** To date, the program has issued calls in areas such as machinery, mobility, structural transformation in production, healthcare and chemical products, and digital transformation. Most recently, a new call titled "Emerging Innovative Technologies" was introduced to support critical investments in future technologies. This call seeks to realize major investment projects that will strengthen local production capacity for strategic products. The program represents a strategic initiative designed to transform industry and position Türkiye as a global production hub. In this context, the Move

High Technology Investment Program HIT-30

Designed to promote sustainable economic growth through technology and innovation, the HIT-30 Program prioritizes economies of scale and seeks to enhance Türkiye's global competitiveness across the entire value chain. Its central objective is to position Türkiye as a global manufacturing base for high-tech sectors by 2030.

HIT-30
HIGH TECH TÜRKİYE
Invest in Future

The program offers robust and tailored incentives for investment in the identified critical areas. These include tax exemptions, grants, public procurement guarantees, site allocations, financial packages and legislative improvements, with support instruments customized according to the specific characteristics and needs of each investment. In addition to financial incentives, the Ministry plays a facilitative role throughout the investment process, ensuring the success of the supported projects.

Key areas include semiconductors, e-mobility, renewable energy technologies, digital technologies and biotechnology. While targeted calls are issued for specific topics, applications are also welcomed for all eligible fields.

Further information can be found at hit30.sanayi.gov.tr

Program will continue to support production-oriented projects that strengthen the industrial and technological ecosystem and contribute to the real economy, with determination.

7. **The HIT-30 High Technology Investment Program was launched with a view to supporting investments in high-technology manufacturing.** Implemented by the Ministry of Industry and Technology as part of Türkiye's vision to become a global hub for high-tech production by 2030, the program aims to foster specially qualified projects across strategically critical technology fields. HIT-30 identifies priority investment areas within seven core sectors: semiconductors, mobility, green energy, advanced manufacturing, healthy living, digital technologies, and communications and space, including complementary investments that support the broader value chain. The program offers a comprehensive package of support to investors, ranging from project-based incentives and market development mechanisms to access to investment sites and favorable financing options. It also provides high-level policy support to facilitate the formation of strategic partnerships. Through project-specific decision-making processes, investors are expected to navigate bureaucratic procedures more efficiently and act swiftly when needed. Projects to be supported will involve investments in new technologies, backed by strong technical capacity, scalable structures and a competitive technological edge. A total of USD 30 billion in incentives is projected for high-tech investments to be made by 2030.

8. **The National Technology Initiative promotes national resilience without excluding global alliances, international partnerships or foreign investments.** Its focus on strategic autonomy does not equate to economic isolation. Türkiye's highly skilled workforce and unique regional position give it a strategic advantage over neighboring countries. Its geographic location, combined with major infrastructure investments made over the past 22 years, has significantly expanded export potential and improved access to global markets. The country's robust industrial infrastructure and supply networks offer strong potential to attract international brands. By harnessing this potential through investment-friendly policies and expanding opportunities for international collaboration, Türkiye aims to drive economic growth and bolster its technological sovereignty.

9. **Türkiye aims to enhance its global competitiveness and achieve technological independence by shaping its industrial and technology policies around critical technologies.** Strategic priority sectors include the defense industry, mobility, artificial intelligence, semiconductors and chip technologies, the space economy, digital technologies and renewable energy. Healthcare technologies, agriculture and food, and smart city solutions also remain high on the innovation and R&D agenda. Investments in these critical areas will not only advance Türkiye's National Technology Initiative but also offer attractive opportunities for domestic and international investors, supporting the country's rise among global technology leaders.

Game-Changers in Defense Industry: Next-Generation Aviation Platforms

UAVs such as Bayraktar TB2, Akıncı and Aksungur have ushered in a new era of capability and confidence in Türkiye's defense industry. These platforms have served as game changers, not only by significantly boosting the defense capabilities of our country and allied nations, but also by exponentially increasing the sector's export potential. Today, Türkiye has attained the top global ranking in armed UAV exports. Building on these achievements, Türkiye will strengthen its position in manned and unmanned combat aerial vehicle (UCAV) technologies and production, through new-generation platforms such as KAAN, Kızılelma and Anka-3.

Efforts to initiate serial production of our national combat aircraft KAAN, which is designed to elevate the vision of our defense industry, address a critical strategic need, and significantly scale up our industrial capabilities—will be completed in the coming period. Producing the aircraft's engine, its most critical component, using domestically developed and nationally owned resources remains a non-negotiable objective.

In light of shifting paradigms in aerial technologies, unmanned systems have been identified as a top strategic priority. Jet-powered unmanned combat aerial vehicles such as Kızılelma and Anka-3 are expected to deliver a high-impact boost to our air defense capabilities. Therefore, the development and production of these platforms will continue to receive the highest level of support. These systems will be enhanced with advanced, domestically developed and nationally owned components, including engines and radar systems. Türkiye aims to maintain its technological leadership in armed UAVs through continued advancements in speed, autonomy, and stealth.

Defense Industry

10. **Türkiye's defense industry has emerged as the leading force in domestically developed and nationally owned technologies.** From unmanned aerial vehicles (UAV) and missile systems to fighter jets, submarines and armored vehicles, the sector's success reflects a well-established R&D infrastructure and extensive experience. This foundation has been reinforced by medium- and long-term planning approaches led by the public sector and executed through strong coordination

among decision-makers, funders, and producers. Over the past 22 years, the Turkish defense industry has demonstrated remarkable growth, as evidenced by performance in domestic and international sales, R&D spending, and employment. The number of defense and aerospace projects has increased from 66 in 2002 to 1,290 in 2024. During the same period, sector turnover rose from USD 1 billion to USD 15.5 billion, while defense and aviation exports climbed from USD 48 million to USD 7.1 billion. Employment in the industry now exceeds 92,000 people. These figures clearly demonstrate that Türkiye has become one of the most capable and influential actors in global defense technologies.[2]

Steel Dome

The Steel Dome Project is a comprehensive, layered air defense system developed entirely through domestically developed and nationally owned capabilities. It integrates air defense systems operating at various altitudes (low, medium, and high) and ranges (short, medium, and long) into a networked structure, enabling real-time data sharing and AI-supported decision-making for rapid and effective responses.

Innovative projects under the TÜBİTAK umbrella—such as ramjet development efforts and the Gökhan missile, as well as the Gökdoğan and Bozdoğan missiles developed under the Göktuğ Project—are boosting the range and sophistication of our defense systems.

The development process and manufacturing capacity of these air defense systems, to be produced by ASELSAN, ROKETSAN, and other stakeholders, will be strongly supported through project-based incentive mechanisms. TÜBİTAK's institutional expertise and capacity will also be actively utilized in the project's R&D phase.

11. **Thanks to a comprehensive transformation and robust growth in the defense sector, Türkiye has become a key player in regional and global power dynamics.** Our country has established global leadership in UAV and UCAV technologies—not only achieving technological superiority but also rapidly expanding export volumes in this field. With a domestic content rate exceeding 80 percent, our defense industry has developed domestically developed and nationally owned solutions across land, sea, air, and space platforms, significantly reducing external dependence and providing greater flexibility and strength to our national security strategies. Since 2002, nearly 900 incentivized projects and investments exceeding TRY 120 billion have reinforced the sector's infrastructure. In addition to these investments, around 1,500 TÜBİTAK-supported projects have

advanced a steady, R&D-driven growth model in defence industry. The knowledge and experience gained in the defense industry have not only helped meet the needs of our security forces but also positioned Türkiye as a strategic player in global markets. Work in next-generation fields such as cybersecurity, artificial intelligence, autonomous systems, and space technologies is enabling Türkiye to emerge as a country shaping the battlefield of the future. Our national combat aircraft KAAN has successfully completed its first test flights. Meanwhile, the ongoing test phases of the Kızılelma and Anka-3 projects represent major strides in the development of high-tech unmanned combat platforms. In addition, through MİLGEM projects and platforms like TCG Anadolu, Türkiye has strengthened its maritime sovereignty and is also helping meet the defense needs of allied and friendly nations through competitively priced, high-performance products. These achievements reflect a strong ecosystem built on long-term planning, public-sector-led investment, and international partnerships. Together, they have established the defense industry as a strategic cornerstone of the Century of Türkiye vision.

12. **Taking Türkiye's already strong position in the defense industry even further and expanding its export capacity will depend on fostering innovation in strategic technologies and products.** R&D and investment incentives will be broadened to deliver next-generation solutions in areas such as unmanned aerial and underwater vehicles, missile and air defense systems, humanoid robotics, propulsion, engine, laser, sensor, and fuel technologies. Support will be provided for the commercialization of products that have completed the R&D phase. Programs will be launched to drive the digital transformation of production processes, integrate high-precision manufacturing technologies, and build a highly skilled workforce to support the sector's growth momentum. To increase exports, international partnership mechanisms will be strengthened, helping domestically made products become more competitive in global markets. In particular, the development of joint defense projects with European countries will be accelerated.

13. **Technological assets, skills, and technological innovations generated for the defense industry will be adapted for civilian use through dual-use strategies.** Interaction between the defense industry and the private sector will be enhanced to ensure that these advances benefit sectors such as healthcare, textiles, materials, and software technologies. Mechanisms for two-way technology transfer will be established. Equally important as the cross-sector spread of defense technologies is ensuring the civilian applicability of the tools and models developed by the public sector to support the defense industry. In this context, the Industrialization Executive Committee (SAİK) will introduce mechanisms that prioritize domestic products and technologies in public procurement—particularly in critical fields such as pharmaceuticals and medical devices, rail systems, and information and communication technologies. Public-private partnerships will also be diversified in research and commercialization processes in these priority areas.

Mobility Sector

14. **With its robust automotive industry, Türkiye is poised to lead the transformation in the mobility sector.** The country currently hosts production by 13 brands, including 8 global manufacturers, and has seen its annual passenger car output

My First Car - Domestic Vehicle Family Support Program

In an effort to strengthen Türkiye's domestic automotive infrastructure and improve access to car ownership, a new program is being developed for families with three or more children. The program aims to offer long-term financing options that align with the purchasing power of lower-income households.

Demand for the My First Car–Domestic Vehicle Family Support Program is expected to be strong. By increasing vehicle ownership among lower-income groups, the program will enhance family mobility and contribute to overall social well-being. Supplying this demand with brand-new, domestically manufactured vehicles will also help lower the average age of the car fleet and reduce per-vehicle carbon emissions.

rise from around 200,000 to 1.365 million[3] over the past 22 years. Backed by such production capacity and experience, Türkiye stands on strong footing. Investments by international manufacturers such as Ford, Renault, Toyota, Hyundai, and Mercedes-Benz, along with the emergence of domestic brands like Togg, continue to diversify and expand Türkiye's capabilities in the automotive sector. However, this sector is undergoing a major technological transformation, which, in addition to bringing new opportunities, also poses certain risks for Türkiye. The automotive industry, which generates nearly USD 36.75 billion in exports[3] and employs close to 500,000 people[4], is one of the key pillars of the national economy. It must adapt to this shift by leveraging its strong R&D and innovation ecosystem, skilled workforce, and cooperation between main and supplier industries. In keeping with the goals of making cars more affordable and increasing the share of local production in the domestic market, it is important not only for existing manufacturers to adopt new technologies but also to attract rising global players to establish production and innovation hubs in Türkiye. To guide this transformation in the country's top exporting sector, the "Mobility Vehicles and Technologies Strategy Roadmap" was published in 2022. The roadmap lays out concrete targets across several strategic domains, from electric vehicle and battery production to charging infrastructure, autonomous vehicle development, and testing facilities. It sets ambitious goals such as increasing the market share of electric and plug-in hybrid vehicles to 35 percent by 2030 and raising the domestic content ratio to 75 percent. Moreover, targets such as making Türkiye a European leader and a global top-five producer of electric, connected, and autonomous light and heavy commercial vehicles make it all the more important to implement, monitor, and revise these strategies to sustain the country's competitive edge.

15. **Togg represents more than a mere electric and smart vehicle—it also symbolizes Türkiye's transformation in the automotive industry.** As one of the flagship projects under the National Technology Initiative, Togg supports innovation and entrepreneurship through partnerships with more than 40 startups. As Türkiye's first domestically developed electric car, Togg has played a catalytic role in expanding charging infrastructure and strengthening the broader mobility ecosystem. Its innovative approach and close ties to a strong tech-enterprise ecosystem have accelerated the transformation of the mobility sector. This transformation is boosting Türkiye's global competitiveness and paving the way for new business and innovation opportunities.

16. **Togg's preparation for export marks a critical step toward establishing the brand globally.** In Togg's journey to become a global brand, the development of new models and technological innovation will be vital. In this process, equipping Togg with autonomous driving capabilities engineered in Türkiye will further enhance its innovative identity. Achieving global success will not only accelerate the transformation of the mobility ecosystem and attract further international investment

Domestic Autonomous Vehicles

To advance an autonomous vehicle ecosystem in Türkiye, R&D efforts focused on autonomous driving systems are being supported, including the development of critical components such as sensor technologies, AI-powered driving software, and connected vehicle infrastructure. In the meantime, legal and technical frameworks are being implemented to enable the safe testing of autonomous vehicles on public roads, with the overarching goal of establishing Türkiye as a regional technology hub in this field.

Togg, Türkiye's domestically developed and nationally owned automotive brand, has already launched production and is steadily gaining market share. The Ministry of Industry and Technology's incentives and support for autonomous system development are helping Togg and other domestic manufacturers build strong capabilities in autonomous technologies. This will position Türkiye as an innovation hub offering competitive solutions in global markets and will strengthen product and technology exports within the mobility ecosystem. Moreover, the development processes for autonomous systems by other automotive brands operating in Türkiye are also expected to gain momentum.

but also support Türkiye's ambition to lead in technology and innovation. Investments in the autonomous vehicle ecosystem will strengthen domestic supply chains while contributing to sustainable transport policies through next-generation mobility solutions. These steps toward integration with the smart transport systems of the future will accelerate Türkiye's mobility transformation and strengthen its position on the global technology stage.

17. **The public sector is playing an active role in guiding the automotive transformation.** The Ministry of Industry and Technology and its affiliated institutions are working to position Türkiye as a global hub for electric, connected, and autonomous vehicle technologies. Through the Technology-Focused Industrial Move Program, 38 investment projects—worth over TRY 32 billion—are being supported in the mobility sector. These include the development and mass production of smart urban electric public transport vehicles, advanced driver-assistance systems, intelligent camera systems for self-driving vehicles, and investments in the electric vehicle charging ecosystem. In parallel, efforts are underway to align with the European Green Deal through goals such as carbon-neutral production processes and sustainable vehicle manufacturing. Within the framework of the HIT-30 High Technology Investment Program, mobility has been designated as one of seven priority sectors. Under this heading, calls have been issued for projects focused on electric vehicles and battery technologies. Future calls will also include Fuel Cell Vehicles, High-Speed Electric Rail Systems, Micro Air Vehicles, and Unmanned Ground, Aerial and Maritime Vehicles.

High-Speed Train Consortium

Rail systems are emerging as a sustainable and cost-effective solution to the increasing demand for transportation driven by population growth and urbanization. The domestic and nationally owned production of rail system vehicles, including all of their components, not only contributes directly to the reduction of transport-related carbon emissions but also helps strengthen Türkiye's economic independence. Türkiye has already made significant progress in the production and export of rail vehicles with a high domestic content rate. The existing capacity, capabilities and accumulated expertise will be brought together under the goal of developing a domestically developed and nationally owned high-speed train (HST) system that will elevate Türkiye to the next level in this field. The high-speed train sets, which will be manufactured with a high level of domestic content, will comply with the Technical Specifications for Interoperability (TSI) of the European Union Railways. In addition to meeting the demand for rolling stock within Türkiye's expanding national high-speed rail network, these domestically developed train sets will also be exported to nearby regions.

18. **The innovation ecosystem emerging within the mobility sector is also becoming a source of inspiration for other industries.** Over 1,000 tech startups have applied to acceleration programs run in partnership between Togg and Bilişim Vadisi (Technology Development Zone), and more than 120 startups have found opportunities to collaborate with OEMs, suppliers, and members of the Türkiye Mobility Cluster. These partnerships are essential for enhancing the sector's R&D and innovation capabilities. As of December 2024, over 240 tech startups operating in technoparks have received support for R&D projects in mobility vehicle technologies. Meanwhile, TÜBİTAK's scholarship and grant programs have funded 1,147 projects and supported 3,642 researchers and young talents in the mobility field over the past 22 years, with total funding reaching TRY 6 billion in 2024 fixed prices.

19. **Türkiye aims to become a regional hub for battery production through investments in battery modules and subcomponents.** Battery production technologies are critically important for electric vehicles, renewable energy storage systems, and portable electronics. With global EV sales currently around 40 million and expected to surpass 250 million by 2030[5], battery demand is set to rise significantly. In line with these trends, the global battery market—valued at approximately USD 120 billion in 2023—is projected to reach USD 330 billion by 2030.[6]

20. **To achieve its goals in mobility and cutting-edge technologies, Türkiye views battery and energy storage technologies as strategic areas.** As EV sales rise globally and carbon-neutral technologies aimed at combating climate change gain ground, investments in these fields are growing rapidly. As of September 2024, 22 companies—with a combined fixed investment of TRY 182 billion and the potential to create nearly 6,000 new jobs—are receiving support under the incentive scheme. Under the "mobility" call of the Technology-Focused Industrial Move Program, four investments and R&D projects, which are worth TRY 3 billion, have been launched in the energy storage and battery sector. TÜBİTAK programs have provided support worth TRY 3.83 billion (2024 fixed prices) for 687 projects and 1,170 scientists and researchers working in battery and energy storage technologies since 2002. Nevertheless, to become a global leader in this field, Türkiye must attract further investment. A significant step in this direction is the allocation of a USD 4.5 billion budget under the HIT-30 High Technology Program specifically for battery technologies. HIT-30 and other incentives will also help facilitate the integration of foreign capital into the sector. These strategies will allow Türkiye to become a regional hub for energy storage technologies. At the same time, planned investments and initiatives to secure critical raw materials and minerals for battery production will strengthen Türkiye's position in the global battery supply chain. Under HIT-30, prioritizing areas such as Batteries for Energy Storage, Battery Components (including Cathode Active Materials, Electrolytes, and Separators), and the Processing of Critical Minerals for High Technology are all key steps. Focusing on innovations in battery systems, autonomous flight control, and materials for Electric Vertical Take-Off and Landing (eVTOL) vehicles—one of the most dynamic components of the mobility transformation—will also help Türkiye gain a strong presence in this fast-growing global market.

21. **E-fuels are expected to play a significant role in reducing mobility-related emissions, particularly for vehicle types where electrification remains challenging.** While battery or hydrogen fuel cell technologies offer an effective solution for decarbonizing passenger cars, cargo ships and aircraft remain heavily dependent on fossil fuels. E-fuels are synthetic fuels produced by synthesizing green hydrogen with captured carbon, using renewable energy in the process. These fuels can be used in internal combustion engines without modification and within existing distribution and storage infrastructure. Although currently more expensive than fossil fuels, technological advancements and supportive policies are expected to gradually reduce the cost of e-fuels. In addition to expanding electrolysis capacity, R&D focused on scaling up e-fuel production will make a significant contribution to this transition.

Artificial Intelligence

22. **The rapid advances in artificial intelligence (AI) technologies in recent years have ushered in what many consider a revolution, both for their disruptive impact and the unprecedented pace of their adoption.** This revolution, which is driven by the convergence of advanced technologies such as machine learning, deep learning, natural language processing, and artificial neural networks, has enabled systems that can process vast datasets, learn autonomously, and make complex decisions. For example, multimodal systems such as ChatGPT, which has achieved widespread use in less than two years, and projects under development by Google DeepMind, stand out for their ability to process not only language but also visual and auditory data. OpenAI's GPT model has marked a major leap in the field of natural language processing, producing text with a fluency and coherence comparable to that of humans. Newer versions of the model have gone even further, integrating capabilities such as image processing and access to real-time information. Similarly, Google's DeepMind team has made it possible for a single model to perform multiple tasks, particularly through projects involving general-purpose robots like RoboCat. China's release of the DeepSeek model as open source, which is reportedly trained using significantly less hardware and energy than its global counterparts, has highlighted both the momentum and shifting dynamics in AI development. Such breakthroughs are driving transformative change not only in the technology sector, but also across healthcare, finance, education, agriculture, and many other fields. In healthcare, AI-powered imaging systems are revolutionizing early diagnosis and treatment by improving both speed and accuracy. In education, AI enables personalized learning experiences. In manufacturing, it streamlines production processes, boosts efficiency, automates quality control to minimize errors, and strengthens supply chain management for greater cost-effectiveness. For instance, AI infrastructure in smart factories allows robots to perform complex tasks, supports real-time production monitoring to detect anomalies, and facilitates predictive maintenance planning. In technology development, AI accelerates R&D efforts while supporting innovation and creation of new products and services. In particular, big data analytics and machine learning help businesses better understand market trends, anticipate customer needs, and deliver more personalized offerings.

23. **Türkiye has already taken significant steps toward advancing AI technologies.** The National Artificial Intelligence Strategy, published in 2021, was developed under the vision of "creating value on a global scale with an agile and sustainable

AI ecosystem for a prosperous Türkiye." The strategy outlines the following priorities: Training AI experts and increasing employment in the domain; supporting research, entrepreneurship and innovation; facilitating access to quality data and technical infrastructure; regulating to accelerate socioeconomic adaptation; strengthening international cooperation; and accelerating structural and labor transformation. To foster a dynamic AI ecosystem and bridge the gap between academic research and industry needs, the Artificial Intelligence Institute was established under TÜBİTAK BİLGEM. The Institute works to develop AI-based solutions across various sectors including finance, smart manufacturing systems, agriculture, food and livestock, climate change and sustainability, education, and e-commerce. One of its flagship initiatives is the Turkish Large Language Model Project, which seeks to reduce foreign dependency and develop generative AI models tailored to the Turkish language. The project aspires to build language models using one trillion tokens and has already produced

The Economic Potential of Artificial Intelligence in Türkiye

A 2024 international study titled "The Economic Potential of Artificial Intelligence in Türkiye" provides an in-depth analysis of how AI could contribute to and shape the Turkish economy. According to the report, widespread AI adoption could result in a substantial increase in Türkiye's GDP over the next decade. It estimates that AI could generate USD 50–60 billion in additional annual value, equivalent to a 5% rise in GDP. This economic gain is expected to stem from productivity increases and the redeployment of time saved through automation to more value-added activities.

The report also assesses the potential effects of AI on Türkiye's workforce. It projects that 55% of jobs will benefit from a surge in productivity through collaboration with AI, 41% will remain largely unaffected, and the remaining 4% may be partially or entirely transformed. It further emphasizes that any job losses stemming from such transformations can be offset by new employment opportunities created by AI.

To fully capture the benefits of AI, the report recommends strengthening innovation capacity and establishing a robust regulatory framework.

In particular, it calls for increased investment in AI research and development, faster adoption of AI in the commercial sector, especially among small and medium-sized enterprises (SMEs), and the development of a skilled workforce through training and talent acquisition.

It also warns that delaying adaptation to the AI revolution by just five years could reduce the potential GDP gain from 5% to only 1%.

Kaynak: https://implementconsultinggroup.com/article/uretken-yapay-zekanin-turkiyedeki-ekonomik-potansiyeli

Türkiye's largest foundation model, trained on 300 billion tokens. While its initial focus is on text processing, later stages will expand to multimodal systems capable of analyzing images and audio. As the first institution in Türkiye with this level of focus and structure around AI, the Institute not only serves as a national hub but also offers a model for development in other emerging technologies.

24. **For Türkiye, the AI revolution is not only a matter of technological progress but also one of strategic and economic significance.** The country's future competitiveness and technological leadership will depend on how effectively it can develop and adopt artificial intelligence technologies. To that end, building a comprehensive ecosystem that supports R&D and innovation infrastructure for AI technologies, and expedites the commercialization and dissemination of AI-based solutions is essential. TÜBİTAK's Artificial Intelligence Institute plays a central role in activating the national AI research ecosystem and facilitating robust stakeholder partnerships. The designation of Large Language Processing Models as one of the 30 strategic priorities under the HIT-30 High Technology Investment Program is particularly noteworthy. To further strengthen national capacity, public support for R&D and investment in domestically developed AI models should be scaled up through HIT-30 and similar mechanisms.

25. **Today, the success of the world's leading technology companies stems largely from their ability to extract economic value from data.** These companies harness massive datasets using AI, big data analytics, and machine learning, grounding their strategic decisions in data-driven insights. Giants such as Amazon, Google, and Apple analyze user behaviors and preferences to offer highly personalized services, driving both customer satisfaction and long-term loyalty. In this context, advanced data processing and high-performance computing (HPC) infrastructures allow companies to store and analyze big data, increasing their operational efficiency. Supercomputers and HPC systems play a key role in new product and service development as they enable complex modeling and simulations. These firms also make significant investments in data security and privacy to build trust and enhance regulatory compliance. Their capabilities, which are rooted in the data economy, have enabled them to maintain global leadership and deliver continuous innovation.

26. **To strengthen Türkiye's data processing infrastructure, a new supercomputer has been commissioned within the Turkish National Science e-Infrastructure (TRUBA), which offers high-performance computing and data storage capabilities.** In this context, TÜBİTAK ULAKBİM's next-generation data center and Türkiye's highest-capacity supercomputer, ARF, have been made available for use. TRUBA supports the high-performance computing needs of universities, public institutions, and the private sector. The ARF system, equipped with direct liquid cooling technology, serves academic researchers as well as those from the public and private sectors, who work in computational sciences including climate modeling, biotechnology, basic sciences, and medical sciences, enabling the development of innovative solutions for the future. Through the TRUBA Data Center and the ARF Computing Cluster, Türkiye is adding a new dimension to its scientific research capacity and enhancing its global competitiveness. With support from the Ministry of Industry and Technology, the MareNostrum5 supercomputer, which has been established and operated by a consortium that includes Türkiye

(through TÜBİTAK ULAKBİM), Spain, and Portugal, was ranked 35th worldwide on the Top500 list published in November 2024. The MareNostrum5 system is accessible to researchers from all sectors through EuroHPC Joint Undertaking calls and national-level applications. The second phase of the ARF cluster, ARF-ACC, provides computing resources to researchers working on AI technologies. Furthermore, the BSC AI Factory (BSC-AIF)—a project supported by the Ministry of Industry and Technology, in which TÜBİTAK is a partner—has been selected as one of the first seven AI Factories to receive support from the EuroHPC Joint Undertaking. Updating MareNostrum5 into a supercomputer optimized for AI is expected to expedite the development of industrial and public AI ecosystems. To ensure clarification of rules on data sharing at national level for data governance and promote the effective use of data processing infrastructure, it is essential to establish strategies that foster the creation of sector-specific data spaces, such as the Public Data Space, which enables secure and controlled data sharing. Equally important for facilitating data sharing, is the availability of neutral and trustworthy data-sharing service providers, along with mechanisms aligned with open data policies to allow the reuse of datasets for scientific and commercial purposes.

27. **The AI revolution hinges not only on the integration of these technologies into professional and industrial life, but also on their responsible and secure use.** This revolution brings new challenges concerning data security and ethics. Assessing the impact of AI on individuals, society, and the environment is critical to ensuring its responsible, fair, and trustworthy deployment. For instance, AI–based fake content generation (deepfake) technologies accelerate the spread of political disinformation. Accordingly, new regulatory frameworks must be developed to ensure the ethical and secure use of AI. Ethical use also requires the integration of moral and societal values into the development and implementation of these technologies. To meet the growing demand for a qualified workforce in AI, the goal is to introduce fundamental AI skills before higher education, expand university-level capacity, launch new specialization programs, and increase both the number and qualifications of students in this field. AI ethics is a core component of such education. In this context, the United Nations Future Pact and its annex, the Global Digital Compact—to both of which Türkiye has contributed—constitute concrete steps toward setting global principles for developers and users of AI in areas such as ethics, transparency, and safety. Türkiye is also pursuing international partnerships through its membership in the Global Partnership on Artificial Intelligence, its participation in the Digital Europe Programme, and its involvement in the EuroHPC Joint Undertaking.

Quantum Technologies

28. **Quantum technologies are enabling transformative innovations in positioning, imaging, computing, communication, sensing, and security.** Quantum computers offer significant advantages in solving complex mathematical problems, large-scale optimization, molecular simulation, AI, big data analysis, and cryptography. In addition to high-speed, efficient computing, quantum encryption methods bolster data security; quantum sensors allow for precise measurements; quantum sensing enhances next-generation radar and imaging systems; and quantum communication technologies, which are enabled by quantum entanglement and quantum key distribution, allow for ultra-secure data transmission. Together,

TÜBİTAK National Quantum Institute

The National Quantum Institute will coordinate Türkiye's research and technology development efforts in the field of quantum technologies. The institute will focus on building infrastructure and human resources, executing high-tech projects, and developing quantum computing, communication, and sensing systems for both civilian and military applications.

Among its key goals are the production of superconducting and photonic quantum computers and their application in cryptology and cybersecurity. In the field of quantum communication, the institute will pursue the production of crystal or diamond-based quantum emitters, photonic circuits, and single-photon detectors. A Rydberg-based quantum antenna will be developed, and, in collaboration with the Presidency of The Republic of Türkiye Secretariat of Defence Industries a prototype quantum radar/LiDAR system will be produced.

these technologies unlock new applications across a range of sectors. They are set to drive major breakthroughs in finance, pharmaceutical development, medicine, geophysics, materials science, and defense. To fully harness these opportunities, it is essential to support research, development, and investment in quantum technologies.

29. **Türkiye has recently given momentum to its publicly supported R&D activities in quantum technologies.** Several projects, coordinated by TÜBİTAK have been launched, and the Quantum Technologies Department was established within TÜBİTAK BİLGEM in 2023. This department aims to position Türkiye as a leader in quantum technologies by conducting research and developing systems in quantum computing, communication/cryptography, imaging, sensing, and metrology. The forthcoming establishment of the National Quantum Institute under TÜBİTAK will further expand Türkiye's capacity in this field. The institute will act as a national coordinator, bringing together stakeholders, enhancing infrastructure and talent development, and managing project-based initiatives. Meanwhile, the Presidency of The Republic of Türkiye Secretariat of Defence Industries and universities continue to support research into quantum security and sensing technologies. To that end, ASELSAN has founded KUANTAL (Quantum Research Laboratory) to advance its work in this area. Türkiye's first domestically developed quantum computer, QuanT, was recently launched by TOBB University of Economics and Technology. Moving forward, international collaborations led by the public sector and investments from the private sector will be pivotal in building national capacity in this field.

Semiconductors and Chip Technologies

30. **Semiconductors—critical components in virtually all electronic devices—are in increasing demand as new technologies continue to advance.** In particular, the market for AI chips, which are vital for developing, training, and running generative AI models, is rapidly growing. Global semiconductor sales have surpassed USD 600 billion, and the sector operates

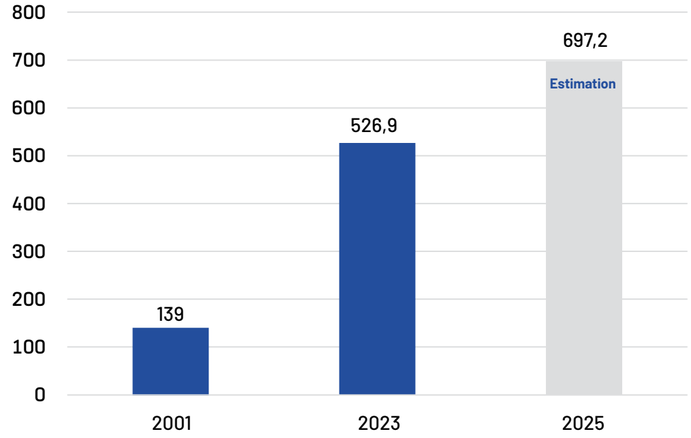


Figure 1: Global Semiconductor Sales (billion USD)
Source: WSTS (World Semiconductor Trade Statistics), Fall 2024 Semiconductor Industry Forecast.

within a complex and highly globalized value chain. The high costs associated with advanced chip production (under 10 nm) necessitate economies of scale in semiconductor production and allow only companies with massive investment capacity to operate in this field.

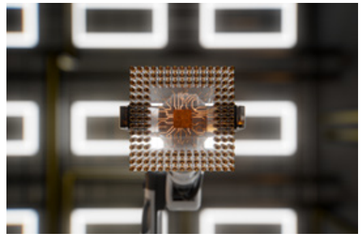
31. **Countries and regions that specialize in semiconductor production operate within intricate dynamics of cooperation and competition.** The chip manufacturing process involves design, which is based on extensive R&D, using electronic design automation software and reusable intellectual property blocks, followed by fabrication, assembly, testing, and packaging, often performed by specialized firms across different countries. The final distribution of chips to electronics manufacturers is also managed by dedicated service providers. Today's global semiconductor supply chains incorporate

no fully autonomous semiconductor ecosystem that is completely independent of foreign technology, equipment, raw materials, or components. This dependency increases global supply chain vulnerabilities and poses risks to economic stability. While the United States maintains dominance in design, Taiwan, South Korea, China, and Japan lead in manufacturing. However, disruptions from trade tensions and the COVID-19 pandemic have prompted many countries to implement proactive industrial policies aimed at increasing domestic semiconductor capacity. For example, as a strategic move towards self-sufficiency in semiconductor production, the United States has passed the CHIPS and Science Act to address vulnerabilities in technological supply chains. Under this law, which came into force in 2022, the U.S. allocated USD 52.7 billion to restore domestic design and manufacturing capacity, guarantee domestic supply and enhance global competitiveness. The European Union, through its 2023 Chips Act, aims to expand its global market share and strengthen technological sovereignty by mobilizing more than EUR 15 billion in public and private investment.[7] In May 2024, China launched the third phase of its Integrated Circuit Industry Investment Fund, worth USD 47.5 billion.[8] This fund is part of the country's strategy to grow semiconductor manufacturing and increase global competitiveness.

32. **Countries active in the semiconductor sector are making intensive efforts to achieve self-sufficiency in this strategically vital area and to secure technological dominance.** The strategic importance of semiconductors lies not only in their economic value, but also in their pivotal role in national security. From the defense industry and communication infrastructure to advanced technological products, a wide range of critical sectors depend on semiconductor technologies. As a result, any disruption in the semiconductor supply chain can pose serious risks to both economic stability and national security. To ensure a resilient and sustainable semiconductor supply chain, countries are stepping up investments and updating their national strategies.

33. **One of the key pillars of Türkiye's national technology agenda is to secure a strong and sustainable foothold in semiconductor and chip technologies, while developing a sustainable production capacity in this industry.** While Türkiye already possesses notable capabilities in chip design and production, these capacities are being systematically expanded. TÜBİTAK BİLGEM's Semiconductor Technologies Research Laboratory (YİTAL), the METU MEMS Center, and Aselsan Bilkent MikroNano A.Ş.—through university–industry partnerships—are already engaged in critical chip design and manufacturing initiatives. In 2023, a new call for integrated circuit design projects was launched under the Pre-Competitive Partnership Program to further strengthen Türkiye's design capacity. This initiative supported projects such as isolation chips for electric vehicles, driver chips for LED headlights, and open-source microcontroller designs for the white goods industry. The inclusion of the semiconductor sector in the HIT-30 High Technology Investment Program underscores the strategic priority Türkiye attaches to this field. Under this initiative, the HIT-Chip call has allocated a support budget of USD 5 billion, aiming to establish an annual production capacity of at least 1 million wafers using 65 nm or more advanced technology nodes. The program also promotes investments across the entire chip value chain, from ingot production and wafer fabrication to testing and packaging. Türkiye aims to develop chips using domestic resources that will play a central role in advancing indigenous technologies across several critical domains. These include Application-Specific Integrated Circuits (ASICs), designed for high-speed and high-efficiency single-purpose applications; Field-Programmable Gate Arrays (FPGAs), known for their reprogrammability and speed advantages in prototyping; AI chips integrating ASIC, FPGA, and GPU components; Power Management Integrated Circuits (PMICs) for battery-dependent systems; and Communication Integrated Circuits (CICs). In parallel, a publicly supported, multi-stakeholder national consortium dedicated to semiconductor and chip technologies is being planned. Expected to drive private sector investment in technology-intensive fields, this structure will serve not only to advance R&D but also to scale up production infrastructure and expand investment capacity. A similar approach is envisioned for other strategic sectors such as nuclear energy, biotechnology, and petrochemicals, where publicly supported national consortiums with multiple partners will also be established.

National Chip Consortium



The National Chip Consortium aims to establish the full semiconductor production value chain, including design, manufacturing, packaging, and testing, within Türkiye.

Through this initiative, Türkiye's chip ecosystem will be significantly expanded, its existing design capabilities progressively strengthened, and its dependence on foreign suppliers for critical chip needs eliminated. Chips will be designed by domestic engineers and mass production will be carried out in facilities established within the country. Public procurement mechanisms will be used strategically to drive demand and scale. To this end, the existing capabilities of TÜBİTAK will be enhanced, and targeted investment incentives will be offered to attract global semiconductor manufacturers to Türkiye. By 2028, Türkiye plans to transition to 110 nm chip production technology, enabling the domestic manufacturing of critical chips used in national ID cards and passports. Following this, a 16 nm chip production line will be established through international partnerships, facilitating the domestically developed and nationally owned production of high-tech chips. With the support to be provided under these initiatives, Türkiye's chip production ecosystem is expected to grow significantly over the next five years, and the number of domestic suppliers and qualified professionals in the sector will increase accordingly.

34. **Beyond investment incentives, comprehensive R&D initiatives will be needed to underpin domestic chip production.** These efforts will reinforce Türkiye's technological sovereignty and enhance its competitiveness in the global semiconductor industry. To ensure a secure and sustainable supply of the strategic raw materials needed for chip and semiconductor production, it will be essential to develop local supply capacity while also forging robust international partnerships. These measures will help Türkiye establish a strong, reliable, and independent semiconductor supply chain. Furthermore, TÜBİTAK BİLGEM and TÜTEL will establish a dedicated infrastructure for Avionics Integrated Circuit Design and Testing, supporting Türkiye's ambitions in high-tech defense projects and space technologies. All these strategic steps will contribute to Türkiye's vision of becoming a global leader in semiconductor and chip technologies—advancing its goal of development through technological strength.

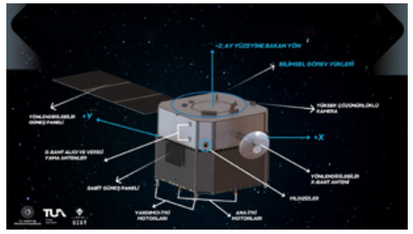
Space Economy

35. **Today, the space economy is expanding its scope to include emerging fields such as space tourism and space mining.** The United States, China, and Russia remain the leading countries in this domain, while the European Union, India, and Japan are other significant players in this global race. Türkiye began its space activities with communication satellites, taking its first step by launching the TÜRKSAT 1B satellite in 1994. In the 2000s, Türkiye accelerated its satellite development efforts, achieving substantial progress in Earth observation satellites, reconnaissance satellites, and CubeSats. Türkiye's first domestically produced communication satellite, TÜRKSAT 6A, was successfully launched on July 9, 2024. The technological competencies gained through TÜRKSAT 6A will be leveraged in subsequent satellite development projects, particularly the lunar mission. Within the scope of the Lunar Program, a spacecraft equipped with a propulsion system developed with national capabilities, which would be designed and produced by domestic engineers and scientists, aims to reach the Moon. This program is critically important for Türkiye to establish itself as an independent and strong actor in space technologies. Another objective of the National Space Program, the "Turkish Astronaut and Science Mission," enables experiments prepared by Turkish scientists to be conducted under microgravity conditions aboard the International Space Station. Our astronauts, Alper Gezeravcı and Tuva Cihangir Atasever, have conducted various experiments in their missions, ranging from biological molecule studies to gene analyses. With new space missions, experiments, and analyses, Türkiye's research capacity and equipment in diverse fields of science and technology will be significantly strengthened. Türkiye also possesses the capacity to establish astronaut training infrastructure that can serve other countries. The establishment and evaluation of these infrastructures will contribute to positioning Türkiye among the leading nations in space activities.

36. **Focusing on the National Space Program's goals and striving to become a strong player in the space economy is an essential necessity for Türkiye.** Among the program's goals are the Lunar Program, Turkish Astronaut and Science Mission, development and commercial use of space technologies, enhancement of satellite communication systems, and integration of space technologies into other sectors. Achieving these objectives will enable Türkiye to secure an independent and strong position in space technologies and to partake in the global space economy. The program also envisions the establishment of a space technology development zone in Ankara.

Lunar Mission

The Lunar Research Program is a key objective within the National Space Program, which encompasses Türkiye's ten-year plans in space technologies. The first phase of the Lunar Research Program, divided into two stages, aims to send a spacecraft designed and produced with national capabilities into Earth orbit through international cooperation; ignite the nationally developed Hybrid Propulsion System; enter lunar orbit; and finally perform a hard landing on the Moon's surface. During the mission, vital data will be collected via scientific payloads onboard the spacecraft, subsystems will be developed, and preparations will be made for the second mission. The first phase, initiated by an agreement signed on December 15, 2021, among the Turkish Space Agency (TUA), TÜBİTAK, TÜBİTAK UZAY, and DeltaV, is approaching the completion of the spacecraft's critical design stage. The spacecraft that will perform the hard landing on the lunar surface is being developed with national capabilities and will incorporate numerous domestic subsystems.



37. **In an effort to commercialize the R&D and production capabilities developed in satellite technologies and contribute to national security, a National Satellite Company will be founded.** Achievements with the BİLSAT, RASAT, and GÖKTÜRK satellites, as well as the national imaging satellite İMECE—with sub-meter resolution—have positioned Türkiye among countries capable of designing and producing its own Earth observation satellites and ground stations. The competencies gained through TÜRKSAT 6A have been applied to produce communication satellites operating at higher altitudes. The domestic development of TÜRKSAT 6A represents a significant milestone toward establishing a national satellite brand. In the TÜRKSAT 6A project, design, subcomponent flight and ground software, production, integration, and testing activities were performed entirely domestically, reaching an overall domestic content level above 80%. The development of integrated software and hardware for satellite-assisted search and rescue, an alternative positioning system network to potentially replace the current global positioning system (GPS), and satellite communication ground station systems and components are of great strategic importance.

Space Technopark

A robust ecosystem is being targeted to replicate the success achieved in defense industry technologies within the domain of space technologies. In this context, the Turkish Space Agency, affiliated with the Ministry of Industry and Technology, was established in 2018.

To support technology development efforts in this field, a space technologies-focused technopark will be established, with the aim of providing the necessary infrastructure, cultivating a highly qualified workforce, and fostering a collaborative environment. A significant portion of the technology development activities required in line with Türkiye's national space policies will be carried out in this technopark. Located in Ankara, this technopark is expected to contribute to Türkiye securing a larger share of the global space economy through the innovative technologies to be developed within its premises.

38. **Efforts to transfer knowledge and technologies gained through space research to other sectors via know-how or technology transfer will create significant opportunities for innovative solutions.** The application of space technologies in the defense industry will considerably strengthen Türkiye's military operations and defense capacity. High-resolution Earth observation satellites will provide major advantages in critical areas such as border security, intelligence gathering, and operational planning. In addition, space programs contribute to productivity improvements across many sectors by enabling applications beneficial to everyday life. For example, remote sensing satellites can monitor natural resources, transportation networks, urban areas, and agricultural lands in real time while gathering critical information relevant to national defense. Communication satellites facilitate effective services in communication and television broadcasting, while positioning and timing information is provided rapidly and with high accuracy thanks to satellites. Following the memorandum of understanding signed between Axiom Space and TUA, studies will be conducted in areas such as microgravity manufacturing, deep space material testing, and logistics in low Earth orbit. Under the Pre-Competitive Partnership Support Program for Satellite Technologies Development Projects, support will be provided to projects aimed at developing satellite technologies for low Earth orbit, their critical subcomponents, ground systems, and dedicated communication infrastructure. Within this scope, all processes related to satellite projects under 200 kilograms, including design, development, prototyping, testing, verification, launch, and in-orbit operational tests, will be supported. The HIT-30 High Technology Support Program has

National Space Program

The Turkish Space Agency (TUA) launched the National Space Program in 2021 to define Türkiye's vision, strategies, goals, and projects in space policy, taking into account global developments and evaluating the country's existing potential. Space programs hold critical importance for countries in terms of scientific and technological development, innovation, industrial transformation, national security and defense, environmental monitoring, and international prestige, serving as a driving force for growth. Although costly, the direct and indirect benefits they provide motivate countries to implement such programs.

Similarly, the National Space Program was formulated with a view to developing Türkiye's space capabilities, achieving international competitiveness, and contributing to scientific research; it was launched to ensure Türkiye's independence in space technologies, support economic growth, and foster scientific progress.

The National Space Program focuses on the following ten main goals:

1. Unification of Satellite Production under a Single Framework and Indigenous Satellite Development Program
2. Lunar Program
3. Regional Positioning and Timing
4. Spaceport and Independent Access to Space
5. Turkish Astronaut and Science Mission
6. Technological Research on Space Weather
7. Observation and Tracking of Space Objects from the Ground
8. Development of the Space Industry Ecosystem
9. Space Awareness and Human Resource Development
10. Space Technology Development Zone

identified the Communications and Space field as one of seven priority sectors. Under this heading, investments in Low Earth Orbit Satellite Systems, Next-Generation Communication Infrastructures, and Smart Communication Devices will be supported. In addition, the Turkish Space Agency will establish a Laser HB11 Fusion Energy Conversion laboratory test infrastructure; this experimental facility will prepare for fusion reaction detection by 2030 and will extend reaction duration.

Healthcare and Smart Living Technologies

39. **Digitalization, demographic changes, and global pandemics are driving a fundamental transformation in healthcare**

technologies. The COVID-19 pandemic exposed vulnerabilities in health systems and accelerated this transformation, hastening the adoption of innovative solutions in the pharmaceutical and medical device industries. Digital health enables remote monitoring of patients' conditions, early disease diagnosis, and more effective treatment processes. For instance, AI-supported diagnostic systems can analyze radiology images to detect serious diseases like cancer more quickly and accurately; wearable devices such as smartwatches and continuous glucose monitors can track critical health parameters and alert users to abnormalities; big data analytics can predict disease spread and inform more effective pandemic control measures. This transformation improves access to medical services while reducing costs, enhances healthcare quality, and increases patient satisfaction by enabling personalized treatment options.

40. **Supported by biotechnological and genomic research, Türkiye has the potential to become a major player in the global pharmaceutical market.** The global market share of biopharmaceuticals—large, complex molecules produced from living cells using recombinant DNA technology—has been growing steadily. The remarkable speed achieved in vaccine development during the pandemic further underscored the critical importance of these drugs. In 2019, biopharmaceuticals accounted for 31% of global pharmaceutical sales; driven largely by COVID-19 vaccines, this figure rose rapidly to 39% in 2021. It is projected to reach 46% by 2028, with the inclusion of cell and gene therapies and biosimilars, up from 41% in 2023.[9] With a market size of USD 9.35 billion, Türkiye ranks among the top 20 global pharmaceutical markets, and biopharmaceuticals make up 17.6% of this market. Currently, 374 biopharmaceuticals and 103 biosimilars have been licensed by the Turkish Medicines and Medical Devices Agency (TİTCK), with 33 of the biosimilars being manufactured domestically. Although Türkiye has yet to develop a fully domestically produced biopharmaceutical starting from cell culture, this field has been prioritized through high-level policy, strategic planning, and incentives. Thanks to USD 1.1 billion in investment incentive support provided to date, the share of domestically manufactured biopharmaceuticals has increased from 8% to 33% in terms of volume, and from 1% to 9% in value, over the past seven years. As local production capacity in the pharmaceutical industry continues to expand, there is a growing need to extend the gains made in conventional generics to biopharmaceuticals, and to increase domestic production of pharmaceuticals and medical devices through investments in biotechnological and genomic research.

National Omics Platform

Omics technologies play a vital role in understanding diseases at the molecular level, early diagnosis, disease progression monitoring, and developing personalized treatment strategies. The National Omics Platform aims to provide a reliable, systematic infrastructure for collecting, storing, and analyzing large datasets, offering advanced solutions in biotechnology and medicine. Integrated with artificial intelligence and personalized medicine approaches, this platform will form the foundation of intelligent health systems based on systems biology. The platform will foster collaboration between academic and industrial stakeholders, paving the way for innovative and pioneering biotechnology work. Thus, it will contribute significantly to biomedical applications ranging from cancer treatment to metabolic disease management.

41. **Developing a robust entrepreneurship ecosystem in health technologies is of critical importance.** Small-scale biotech firms and technology start-ups are playing an increasingly significant role in innovative drug development. In 2023, they were responsible for 56% of new molecules released in the U.S. market. Many large pharmaceutical companies are bolstering their portfolios by acquiring these small biotech firms. According to CBInsights, there are 118 unicorns worldwide in the health and life sciences sector as of the end of 2024, most of which are based in the United States and China. Today, artificial intelligence and big data analytics play a critical role in developing biopharmaceuticals and accelerating clinical processes. Advanced technologies are used to identify drug targets, optimize clinical trials, and define patient populations. Digital health technologies are being integrated into both the development of biopharmaceuticals and patient management processes. Wearable devices and biosensors are employed to measure and optimize the effectiveness of biopharmaceutical treatments. Technology start-ups also play an important role in the development of medical devices. National plans and programs include measures to promote the development of health technologies and support entrepreneurship. The "Smart Life and Health Products and Technologies Roadmap" issued by the Ministry of Industry and Technology in 2022 accelerated the localization initiative for pharmaceuticals, medical devices, and health informatics technologies that are considered critical and strategic. As of December 2024, 1,888 projects are being carried out in 70 R&D centers established by leading companies in the health sector, while over 1,800 projects in health technology are supported across more than 400 technology start-ups located in technoparks. TÜBİTAK's support programs give priority to work in the health sector and are expanding scholarship opportunities in this area. Under the "Productive Healthcare Model," the strategic alignment of universities, research laboratories, research infrastructures, and hospitals—through the establishment of technology transfer offices, incubators, and clinical research centers—will play a key role in strengthening R&D and manufacturing capacities in the pharmaceutical and medical device sectors, as well as in achieving national self-sufficiency.

42. **Türkiye's recent strides in the health technologies sector hold significant importance not only for economic growth and competitiveness, but also for strategic autonomy and national security.** Much like defense technologies, health technologies are vital to national independence and security. While domestically developed defense systems increase national resilience against external threats, health technologies enhance national preparedness and response capacity against global health crises and pandemics. To secure Türkiye's place in the global health market, it is essential to establish long-

Smart Life and Health Products and Technologies Roadmap

In a world undergoing rapid technological transformation, the preparation of advanced product and technology roadmaps has become essential for gaining a foothold in global markets. In this context, the "Smart Life and Health Products and Technologies Roadmap," which was formulated in an effort to foster the development of predictive, preventive, personalized, and participatory healthcare systems in the rapidly evolving "smart life and health" sector, which is one of the priority areas shaped by technological transformation, was published in the Official Gazette of 9 June 2022, as part of the Presidential Circular No. 2022/9. The roadmap aims to promote the development of domestically developed and nationally owned products, steer the course of technological transformation, and set priorities for the efforts to be undertaken.

Shaped through stakeholder input, the roadmap sets out short-, medium-, and long-term strategic goals, policies, and actions for 2022–2030. It includes 9 strategic goals, 4 strategic objectives, 28 actions spanning all timeframes, and 5 critical project proposals. Eight institutions were assigned as coordinators and 17 others as stakeholders.

To ensure effective coordination, implementation, monitoring, reporting, and evaluation of the roadmap, a dedicated Monitoring and Steering Committee has been established. Updates on the status of critical projects and actions submitted by coordinator institutions and agencies are compiled by the Directorate General for Strategic Research and Productivity, which serves as the committee secretariat, and are then presented to the Committee for decision-making and dissemination to all members.

term predictability through public procurement practices similar to those in the defense industry. Over the next five years, oncology is expected to lead sectoral growth, followed by immunology, diabetes, and obesity. In neurology, growth will likely be driven by new treatments for rare neurological disorders, Alzheimer's disease, Parkinson's disease, and migraines. New technologies such as Antibody Drug Conjugates (ADCs), multi-specific antibodies, RNA-based therapies, gene and cell therapies, and radiopharmaceuticals are expected to expand significantly by 2030.

Agricultural Technologies

43. **Ensuring an adequate food supply in response to population growth has become a key issue on the global economic agenda, serving as a prerequisite for achieving self-sufficiency in agriculture and food.** According to United Nations projections, the world population will exceed 10 billion by the mid-2080s. However, several constraints, including limited

agricultural land, adverse effects of climate change, and increasing demand for clean water, present major challenges to scaling up food production. Given these limitations, how food supply will meet the ever-growing demand has become a vital global question. Among traditional measures to ensure food security are region-specific strategic crop cultivation based on water availability, supply-demand balance, sustainable management of natural resources, breeding methods to improve animal production efficiency, and support programs for families, young producers, and women producers.

44. **Sustainable improvement of food supply in both quality and quantity will depend on advanced agricultural technologies.** However, Smart farming technologies allow for comprehensive management of all elements of agricultural production, significantly improving yield and quality while optimizing input use. For instance, although initially developed for industrial applications, Internet of Things (IoT) technologies are now transforming agriculture by enabling connectivity among machines and equipment. Furthermore, drones equipped with various sensors and actuators can perform faster sowing and spraying operations, while enabling precise monitoring of soil and land conditions to determine water, fertilizer, and disease needs. AI and weather prediction models facilitate yield estimation and drought forecasting. Moreover, analytical software incorporating variables such as weather, seed types, soil quality, disease risk, historical data, market developments, and price trends enables informed and data-driven decision-making.

45. **Promoting and scaling up innovative practices such as biotechnological pesticides, functional foods, and advanced agricultural technologies is critical to making agricultural production more efficient, high-quality, profitable, and sustainable.** In this context, Türkiye will develop strategies in the coming period to boost agricultural productivity through biotechnological solutions. Through the use of smart agricultural technologies (including sensors, drones, and artificial intelligence) as well as through genetic breeding and seed development initiatives, agricultural production processes will become both more efficient and more environmentally friendly. These technologies will reduce water and fertilizer use, minimize environmental impacts, lower production costs, and reinforce Türkiye's agricultural sovereignty.

Technology-Based Entrepreneurship

46. **Over the past 22 years, Türkiye's technology entrepreneurship ecosystem has witnessed remarkable growth.** This progress has been driven by a range of factors, including the country's geopolitical position, its young and dynamic human capital, and the diversity of accessible markets. Venture capital investments[10], which stood at just USD 20 million in 2010, reached USD 1.1 billion by 2024. This level of growth has elevated Türkiye to the top ranks among European and MENA countries in the field of technology entrepreneurship. In certain verticals, such as gaming, the country now ranks among the top five globally and in Europe. The 105 technoparks across Türkiye currently host more than 11,000 technology companies. These companies, through their innovation and R&D-driven efforts, are boosting the country's technological capacity. Technoparks, through their embedded technology transfer offices, encourage both academics and entrepreneurs to access national and international resources and help transform academic knowledge into commercially valuable

solutions aligned with industry needs. In parallel, the Turcorn 100 Program offers tailored support to promising future Turcorns with global ambitions. To realize these goals, new regulations will be introduced to encourage greater participation by venture capital funds and angel investors in the ecosystem. To attract international capital and strengthen trust in the ecosystem, public institutions will increasingly act as anchor investors in venture capital funds. By expanding publicly backed fund-of-funds mechanisms, sector-specific and thematic venture capital funds will be established in critical areas such as biotechnology, artificial intelligence, and digital transformation. Encouraging large corporations to take part in these venture capital funds will help innovative solutions scale across broader business networks and contribute to the sustainable growth of the entrepreneurship ecosystem.

47. **Since 2012, TÜBİTAK's Entrepreneurship Support Program (BiGG) has supported entrepreneurs in transforming technology and innovation-driven business ideas into high-value commercial products and services through the R&D-capable firms they establish—offering support from idea stage to market entry.** Over the years, the BiGG Program has become a well-known initiative within the entrepreneurship ecosystem. It seeks to promote entrepreneurship and support the creation of startups capable of developing innovative, high-tech products and services with strong international competitiveness. Entrepreneurs submit their business ideas to BiGG Implementing Organizations (BiGG IO), which help them develop business plans through dedicated training. In Türkiye, 149 BiGG Implementing Organizations are operating under 37 consortia, managing acceleration processes for aspiring entrepreneurs. Since 2012, a total of 48,666 business idea applications have been submitted under 19 BiGG and BiGG Investment calls, with 22,111 entrepreneurs benefiting from BiGG acceleration programs. As a result, 2,378 technology startups have been established, and approximately TRY 2.5 billion in support has been provided. A structural change was made in 2023, transitioning the program from grant-based support to an investment-based mechanism. The BiGG Investment Program was launched, and the TÜBİTAK BiGG Fund was established. Under BiGG Investment Calls, a total of 404 startups have been selected for investment, with a budget allocation of approximately TRY 385 million. In the first nine months of 2024, the TÜBİTAK BiGG Fund accounted for 228 out of the 388 total venture capital investments made in Türkiye, representing 59% of all deals and 92% of pre-seed stage investments. Thanks to the TÜBİTAK BiGG Program, Türkiye has become the leading country in Europe in terms of the number of pre-seed investments. This new investment mechanism demonstrates how effectively public resources can be leveraged to support the entrepreneurship ecosystem.

48. **Venture capital investments in Türkiye, supported by the rapid digitalization triggered by the pandemic, soared from USD 155 million in 2020 to USD 1.1 billion in 2024.** Programs such as Turcorn 100 (announced at the end of 2022) and Tech Visa (launched in 2024) stand out as key initiatives to strengthen the entrepreneurship ecosystem. Between 2019 and 2024, Türkiye attracted approximately USD 5.4 billion in venture capital investments. In 2024 alone, 469 deals accounted for a total of USD 1.1 billion in investments. In terms of deal volume, the most active sectors were artificial intelligence, biotechnology, and health technologies, while SaaS (Software as a Service), artificial intelligence, and grocery delivery ranked highest in terms of investment size. Since 2022, the number of Venture Capital Investment Funds (VCIFs)

Technology and Innovation Fund

The Technology and Innovation Fund (TIF) aims to provide venture capital support to firms engaged in technology and innovation-oriented activities with high growth potential and in need of financing. Capable of investing both directly in startups and in other funds, TIF is designed to make strategic investments and contribute to Türkiye's development vision. Rather than focusing on a single sector, it supports companies active in R&D and technological innovation—fields that are critical for creating high added value and enhancing sustainable competitiveness. In doing so, it contributes directly to the growth of the entrepreneurship ecosystem.

Through both direct and indirect investments, TIF is helping to deepen the technology entrepreneurship and venture capital ecosystems. It is estimated that TIF's portfolio will continue to expand and that additional technology and innovation funds, similar in structure to TIF, will be established with public support.

has rapidly increased to 455. The TÜBİTAK BiGG Fund, which made 27 AI-focused investments in 2024, was the most active fund in this field during the period. Through the Technology and Innovation Fund (TIF), investments were made in 12 technology-focused startups at a certain level of maturity and in three additional funds. With the GO Entrepreneurship Office initiative, pre-incubation and incubation-stage startups will benefit not only from physical space but also from customized consultancy services tailored to their specific needs. Young entrepreneurs will gain one-stop access to investment opportunities and acceleration programs through these offices. Alongside fast-growing sectors such as gaming and fintech, Türkiye aims to make a leap forward in high-investment areas like healthcare and artificial intelligence, while ensuring that investments in the entrepreneurial ecosystem are sustained and continuously expanded. To take regional dynamics into account in investment decisions, the Regional Development Fund (BKF) has been established and it will continue to support entrepreneurs through this channel.

49. **Türkiye's tech entrepreneurship ecosystem in the gaming sector has drawn global attention due to the rapid growth and high-impact achievements of its startups.** With Istanbul emerging as the second-largest hub for game studios after London in terms of studio density, the city has become a focal point—particularly in the mobile gaming space. Numerous Turkish gaming companies have achieved notable success, creating not only a strong impression on the international

GO Entrepreneurship Office

GO Entrepreneurship Offices are being established to enable young people to commercialize innovative and sustainable business ideas by combining them with scientific research and advanced R&D projects in a rapidly evolving technological landscape.

These offices not only provide entrepreneurs with technological infrastructure, mentorship, and consultancy services but also offer extensive support in key areas such as strategic business model development, access to financial resources, marketing strategies, and global expansion. Through these offices, young entrepreneurs will become integral stakeholders in the entrepreneurship ecosystem and gain the opportunity to commercialize their ideas both locally and internationally.

stage but also a ripple effect that continues to inspire a new generation of game studios and founders. These ventures are distinguished by their steady expansion in the global market and growing competitiveness. Türkiye is currently home to 13 investment funds dedicated to gaming, in addition to accelerators and incubators specifically designed to meet the needs of game startups. These resources collectively offer critical early-stage financing and strategic guidance, enabling local talent to rapidly scale and refine their products. Fully aware of the increasing foreign interest in acquisitions and partnerships, Türkiye is taking proactive steps to position the region as a dynamic player in the global gaming industry. These efforts are transforming the ecosystem into a promising environment for investors seeking high-growth, innovation-driven opportunities.

50. **Türkiye aims to enhance international competitiveness and opportunities for collaboration by strengthening its research infrastructure and aligning with institutions within the EU framework.** As of December 2024, there are 1,660 R&D and design centers operating in Türkiye, employing nearly 95,000 R&D personnel. These infrastructures are of critical importance for the development and commercialization of innovative projects. Moreover, innovative financing models are facilitating access to capital for entrepreneurs, enabling them to pursue bold and inventive projects. The Türkiye Tech Visa Program aims to attract foreign entrepreneurs with innovative business models and talents with critical technical expertise. Considered a milestone on the path to making Türkiye a global technology hub, this Program seeks to enhance the international competitiveness of the country's tech-based entrepreneurial ecosystem. Under the Program, participants will be granted a special three-year work permit, and the entrepreneurs accepted into the Program will receive six months of consultancy on legal, financial, and technical matters for their startups to be established in Türkiye.

Global Startup Ecosystem Report (2024)

The Global Startup Ecosystem Index Report evaluates startup ecosystem performance through dozens of parameters, ranging from funding volumes to the impact of unicorn companies on smaller ventures. Published annually since 2017, it provides insights into the global ecosystem and ranks countries and cities accordingly. According to the 2024 edition, global venture capital investments in 2023 dropped to USD 621 billion, marking the lowest level in the past five years. Although nearly 100 new unicorns emerged worldwide in 2023, this figure also fell short compared to previous years.

The United States and the United Kingdom continue to lead the list of countries with the most advanced startup ecosystems. Among the top 40 countries, Indonesia (36th) and Türkiye (40th) recorded the largest upward movements, each climbing five places. The report attributes this momentum and potential primarily to the dynamic and sizable populations of these countries. It further notes a rise in startups focused on clean technology and renewable energy, alongside increased prominence of AI, blockchain technologies, and sectors such as health and finance.

During periods of reduced private sector funding, governments are increasingly intervening to guide the startup ecosystem in sectors and technologies they consider strategic. Examples include defense, space exploration, semiconductors, and health technologies.

In Türkiye, strategic development and support initiatives are being undertaken to strengthen and make the startup ecosystem more competitive. Developed accordingly, the National Technology Entrepreneurship Strategy was introduced as a visionary and inclusive policy document, aimed at establishing a globally competitive technology entrepreneurship ecosystem and positioning Türkiye as a hub for technology ventures.

51. **The National Technology Entrepreneurship Strategy, issued by the Ministry of Industry and Technology in 2022, is part of Türkiye's multi-dimensional policies to achieve technological and economic independence.** The Strategy focuses on five core components to accelerate the development of the tech entrepreneurship ecosystem: accessible financial instruments, opportunity-enabling policies, talent and supportive culture, inclusive support that clears the path, and entrepreneur-friendly market conditions. The key goals for fostering the technology entrepreneurship ecosystem include diversifying and improving access to financing sources, enhancing skilled human resources and infrastructure, and promoting and supporting entrepreneurs. Successful implementation of this Strategy is essential for Türkiye to reach its goals in the field of technology-based entrepreneurship.

52. **To strengthen the entrepreneurial ecosystem, Türkiye must focus on developing innovative solutions in financing models, research infrastructures, and intellectual property rights.** In the field of entrepreneurial financing, alternative and innovative instruments such as venture capital funds, crowdfunding, impact investing, and angel investing should be strengthened and expanded. In this context, in an effort to improve access to finance, a credit guarantee scheme should be developed and used effectively for R&D project financing. Moreover, the Türkiye Financial Reporting Standard should be promoted among SMEs to encourage internal entrepreneurship culture and mechanisms. The country should also facilitate visa access for foreign entrepreneurs with innovative business models and talents with critical expertise in the field of technology. To promote women's entrepreneurship, dedicated financing and support programs should be developed, comprehensive training and mentoring programs should be organized, and platforms should be created to foster collaboration among women entrepreneurs. Istanbul has the potential to become a global hub for entrepreneurship. The establishment of Terminal Istanbul will be a significant step toward realizing this potential.

Science, R&D and Innovation Ecosystem

53. **Achieving Türkiye's goals in science and technology requires deepening interaction among the public sector, industry, and academia, and fostering collaborative working environments.** In this regard, the creation of cooperation networks focused on priority technology areas will enable various stakeholders to develop interdisciplinary solutions. Thematic cooperation networks to be launched under the leadership of TÜBİTAK—such as HEYSEM, CEZERÎ, ARF, and BÎRÛNÎ—will coordinate research and development activities across diverse fields from basic sciences to digitalization, engineering to space sciences, in an integrated manner. These structures will expedite the transformation of scientific research into economic and societal benefits, while also supporting the production of knowledge at international standards and enhancing Türkiye's global competitiveness.

54. **Biotechnological and genomic research holds significant promise for developing innovative solutions, particularly in the health and agriculture sectors.** In the field of healthcare, these disciplines have extensive and critical applications. Priority areas for research include personalized medicine, the diagnosis and treatment of genetic disorders, cancer research, particularly the innovative use of boron, medical device development, and the engineering of organs and tissues through advanced bioengineering methods. Biotechnologically developed drugs, vaccines, and treatment methods will not only strengthen Türkiye's capacity in the health sector but also enhance its global competitiveness. In agriculture, key areas of research and application include genetically modified organisms, plant biotechnology, the integration of nuclear techniques into agriculture, sustainable farming methods, and biofuel production. Innovative technologies in these areas will increase agricultural productivity and contribute to food security. Environmental biotechnology is another essential focus. Research should aim to reduce pollution, develop bioremediation techniques, improve waste management, and support the production of renewable energy. Interdisciplinary fields such as bioinformatics and systems biology—supported by big data analytics—will improve the understanding of biological systems and facilitate the practical application of this knowledge. Enhancing the biotechnology capacities of institutions such as the İzmir Biomedicine and Genome Center and TÜBİTAK MAM, promoting pioneering projects, establishing support mechanisms for the commercialization of biotechnological innovations, and strengthening international partnerships will position Türkiye as a global leader in this field.

55. **For Türkiye to become a leader in chip and semiconductor technologies and ensure its strategic autonomy, investments in human capital and infrastructure are essential.** Universities should establish and expand undergraduate, graduate, and doctoral programs in these fields, while research infrastructure and project funding must be strengthened. Moreover, close collaboration between academia and industry, knowledge transfer, and joint initiatives should be encouraged. Research units to support design, production, and commercialization capacities must be established across various regions and equipped to host large-scale R&D activities. These units should be strengthened to serve as hubs for large-scale R&D efforts and to actively support innovative projects, thereby advancing Türkiye's position as a frontrunner in semiconductor technologies.

56. **Offering training and awareness programs designed to enhance software and IT competencies across society is essential for building the necessary infrastructure for a qualified workforce that drive Türkiye's digital transition.** These programs will equip individuals with the skills needed to thrive in the labor market and contribute to innovation in software and information technologies. In a rapidly evolving technological landscape, preparing society as a whole for this transformation will not only support economic development but also strengthen social cohesion through greater digital literacy. These education and awareness-raising efforts will not only strengthen Türkiye's global competitiveness in software and information technologies but also foster broader participation in the innovation ecosystem—advancing the country's ambition to become a leading nation in the digital era.

57. **It is crucial to develop the scientific and technological infrastructure and strengthen human capital in the field of space and satellite technologies.** Accordingly, universities must establish new undergraduate and graduate programs in areas such as space engineering, astrophysics, and satellite technologies, while also enhancing existing ones. Under the leadership of TÜBİTAK UZAY (Space Technologies Research Institute), and the Turkish Space Agency (TUA), internship and scholarship programs will be provided to young scientists and engineers to cultivate a highly specialized generation of professionals. In addition, astronaut training infrastructure should be established to create an educational system capable of serving international demand. International partnerships will play a pivotal role in accelerating Türkiye's progress in space technologies. Cooperation with global institutions such as the European Space Agency (ESA) and NASA offers considerable opportunities for knowledge and technology transfer. Türkiye's capacity and expertise in this field could also be expanded through joint projects with renowned space agencies such as JAXA in Japan and ISRO in India.

Biotechnology Production Program

The Biotechnology Production Program aims to reduce Türkiye's substantial reliance on imported biotechnological pharmaceuticals and, in the long term, to transform the country into a net exporter in this field. To this end, efforts are underway to enhance the capabilities of biotechnology research infrastructures through partnerships with TÜBİTAK, universities, and the Ministry of Health, while also supporting domestic production by strategically leveraging public procurement. Investments in biopharmaceutical manufacturing are being strongly promoted under the Technology-Focused Industrial Move Program, with long-term financing opportunities offered under favorable conditions.

Recent years have seen significant advances in biotechnology through TÜBİTAK-supported initiatives. A pilot-scale production facility for biotechnological drugs and vaccines, which is expected to make major contributions to the pharmaceutical industry, has been launched as part of the TÜBİTAK Vaccine and Medicine Campus. This facility integrates biopharmaceutical research and manufacturing processes, serving as a vital bridge to industrial-scale production in collaboration with ecosystem stakeholders.

The Biotechnology Specialized Industrial Zone, established in 2022 to build a comprehensive biotechnology ecosystem and elevate Türkiye as a competitive global actor, will serve as a collaborative platform for entrepreneurs, scientists, and industrialists.

58. **TÜBİTAK's various programs are fostering a national interest in science and technology while aiming to train young researchers as the technology leaders of the future.** TEKNOFEST, Türkiye's largest science and technology event, is preparing young people for the world of tomorrow and guiding them on their path toward careers in science and innovation. The festival inspires youth to explore science and technology and encourages them to pursue careers in these fields. With International TEKNOFEST festivals being held across the Turkic States, the Middle East and Africa, and the Balkans and Black Sea regions, Türkiye's rich historical and cultural heritage is being further enriched through the lens of technology.

59. **Modern research infrastructures established at universities, public research institutes, and technology development zones play a pioneering role in Türkiye's national R&D and innovation ecosystem.** These infrastructures have been

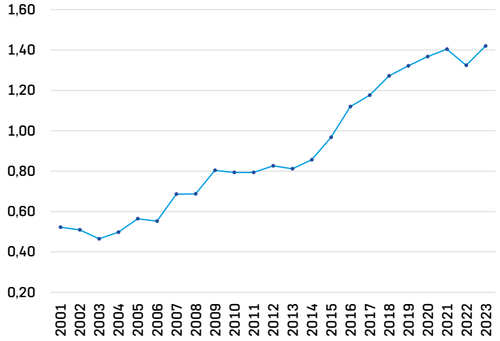


Figure 2: R&D Expenditures as a Share of Gross Domestic Product (%)
Source: TurkStat Science, Technology, and Information Society Statistics.

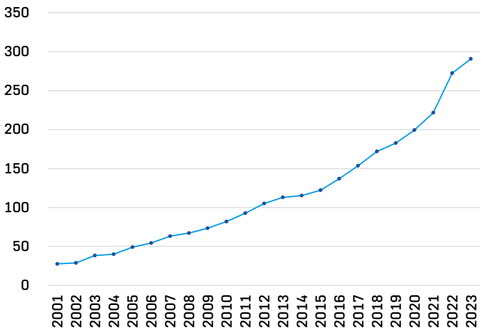


Figure 3: Full-Time Equivalent R&D Personnel (thousands)
Source: TurkStat Science, Technology, and Information Society Statistics.

systematically developed to lay the foundation for scientific and technological progress in the country, and their legal framework has been reinforced through Law No. 6550 on Supporting Research Infrastructures. The law aims to establish mechanisms to ensure the effective management, sustainability, and integration of research infrastructures with industry. The infrastructures established within universities and public research institutes promote interdisciplinary activities and enhance Türkiye's capacity in priority technology areas. Focusing on disciplines such as basic sciences, materials science, biotechnology, and digital technologies, these infrastructures play a critical role in the implementation of both national and international projects supported by TÜBİTAK and other relevant institutions. Moreover, integration with international platforms such as the European Research Area (ERA) enables Turkish researchers to participate more actively in the global scientific community.

60. **Private-sector R&D centers will be more strongly integrated into the national R&D and innovation ecosystem to enhance Türkiye's capacity in strategic and key technologies.** These centers will be steered towards original and deep technologies, such as artificial intelligence, biotechnology, and nanotechnology, in addition to existing areas of strength such as the defense industry. Targeted projects that strengthen sectoral ties and promote cooperation between academia and industry will be encouraged to ensure that these centers develop innovative solutions aligned with national strategic goals. In parallel, efforts will be made to attract global companies to establish R&D centers in Türkiye, thereby enriching the national production ecosystem with international scientific expertise.

Productive Universities: National Technology Workshops

Our universities are expected not only to generate academic research and knowledge but also to play a more active role in developing new technologies and deepening engagement with industry. In this context, the National Technology Workshops project is being implemented to establish workshop facilities at universities and TÜBİTAK-supported science centers, where students can prepare for national and international science and technology competitions. In the initial phase, National Technology Workshops will be established at 50 universities. These workshops will offer students hands-on opportunities, providing all the machinery, equipment, and supplies needed for competition teams and enabling them to develop stronger technological competencies. Students will receive practical training, acquire new skills, and build their technical capabilities. This, in turn, will help expand the pool of qualified R&D professionals and technically skilled personnel required in industrial production.

61. **Creating regulatory sandbox environments in critical technology areas will provide a robust foundation for the safe and effective development of innovative technologies.** These environments allow new technologies to be tested in controlled settings before deployment, enabling risk management. This approach will give momentum to Türkiye's technology development processes, especially in strategic fields such as artificial intelligence, biotechnology, fintech, and semiconductor technologies, while enhancing its position as a reliable technology provider in international markets.

62. **In an effort to keep supporting young researchers, training programs must be expanded in both scope and reach.** TÜBİTAK's Research Project Competitions for middle and high school students encourage scientific inquiry and contribute to fostering a culture of research and development among young people. Meanwhile, Deneyap Technology Workshops are introducing young people across Türkiye's 81 provinces to the world of science and technology. These workshops offer free training in a wide range of fields—from robotics and coding to design, programming, and aerospace technologies. In addition, TÜBİTAK has recently expanded its efforts to promote scientific culture through 35 newly established science centers across the country. These centers support a great variety of workshops and organize engaging activities that help the public explore the exciting world of science. These programs fuel young people's interest in technology and prepare them to become future technology developers. The TÜBİTAK STAR (Intern Researcher Scholarship Program) activates the potential of young researchers in science and technology, offering them opportunities to play an active role in the

Basic Sciences Research Leadership Program (TALİP)

The purpose of the Basic Sciences Research Leadership Program is to cultivate world-class scientists in Türkiye by providing researchers with the necessary infrastructure and support. TALİP seeks to increase Türkiye's international visibility in the production of knowledge in the fundamental sciences and to integrate the country's trained human capital into the national R&D and innovation ecosystem.

In the coming period, TÜBİTAK's research funding will continue to be expanded in basic sciences (Chemistry, Mathematics, Biology, Physics, and Astronomy) with the goal of elevating Türkiye's scientific output to the level of the world's top ten countries.

The Science Olympiads, held in Astronomy-Astrophysics, Mathematics, Physics, Chemistry, Biology, Computer Science, Lower-Secondary Mathematics, and Lower-Secondary Computer Science, promote interest in fundamental sciences among youth. Scholarship programs will continue to be developed for students who achieve high scores in the national university entrance exam and choose to study fundamental sciences at universities across the country. Dedicated quotas for graduate, doctoral, and post-doctoral scholarships and research will be allocated to support fundamental science disciplines. Financial support mechanisms will be expanded for national lead researchers conducting pioneering studies in basic science fields, as well as for R&D projects in these areas. Furthermore, more researchers will be given the opportunity to undertake potentially high-impact projects in basic sciences through the European Research Council.

R&D and innovation ecosystem. Furthermore, the Undergraduate Research Projects Support Program also enhances the project development skills of associate and undergraduate students. These programs increase young people's interest in science and technology and encourage them to pursue careers in these fields. Sustainable development within Türkiye's science, research, and innovation ecosystem will be made possible through the active participation of young people and lead researchers alike. To this end, scholarships, internships, and hands-on training opportunities are being expanded to encourage youth participation in scientific projects. While young researchers invigorate the ecosystem by putting their innovative ideas into practice, experienced researchers shape and guide the process with their knowledge and expertise. Reverse brain drain programs help strengthen Türkiye's human capital by attracting qualified Turkish researchers living abroad and integrating their expertise into the country's innovation system.

63. **In Türkiye, research infrastructures established with public funding must be more deeply integrated into partnerships within the European Research Area (ERA) in order to strengthen their R&D and innovation capacities, increase international visibility, and foster two-way knowledge and technology transfer as well as skilled researcher mobility.** The most critical step in this regard is the preparation of the Türkiye Research Infrastructures Roadmap, with input from relevant stakeholders, and the subsequent efforts to secure its inclusion in the European Research Infrastructures Roadmap, published by the European Strategy Forum on Research Infrastructures (ESFRI). This initiative, which will enhance collaboration between Türkiye's research infrastructures and those of EU member and associated countries, will allow Türkiye to benefit more comprehensively from the EU Framework Programs and take on a more active role in collaborative networks. Currently, international joint R&D projects are being supported through bilateral scientific and technological cooperation agreements signed with 107 institutions across 74 countries. In addition, 35 multilateral cooperation platforms offer international partnership opportunities in key thematic areas including smart energy systems, personalized medicine, cancer, semiconductor and chip technologies, critical raw materials, quantum technologies, sustainable agriculture, and advanced manufacturing technologies. Programs such as Eureka, CORNET, and IRASME support SMEs in integrating into global value chains and accessing new markets. To date, under Horizon Europe—the world's largest publicly funded R&D program—Türkiye has secured EUR 307.2 million in funding across 611 projects, with Turkish researchers acting as coordinators in 47 of them. These efforts, aimed at enhancing Türkiye's international visibility and expanding scientific collaboration, will be further intensified. In the coming period, partnerships between Türkiye's research infrastructures and leading international public research centres such as the Netherlands' TNO, South Korea's ETRI, Taiwan's ITRI, and Belgium's IMEC will be strengthened.

TEKNOFEST

Designed to position Türkiye as a global leader in technology and innovation, TEKNOFEST was launched in 2018 under the leadership of the Ministry of Industry and Technology and the Turkish Technology Team Foundation (T3 Foundation), in partnership with universities, governmental organizations, and technology companies. The main objectives of the event include boosting youth interest in STEM (Science, Technology, Engineering, and Mathematics), promoting the development of domestically developed and nationally owned technologies, encouraging the emergence of innovative ideas, and raising public awareness on technology by expanding digital literacy.

Each year, TEKNOFEST appeals to a broad audience, from students to professionals, raising awareness in the fields of technology and science. Through competitions and events, the festival supports young people and entrepreneurs in bringing their innovative projects to life. In doing so, it paves the way for technological advances that contribute to Türkiye's economy in line with its goals for domestic and national production. TEKNOFEST also attracts international participants and investors, helping to promote Türkiye's technological potential on a global scale.

Since its inception, the festival has been held in İstanbul, Ankara, İzmir, Gaziantep, Samsun, and Adana, reaching increasingly larger audiences each year. Within just six years, the number of applicants to TEKNOFEST competitions has multiplied exponentially, now exceeding 1.5 million annually. With its wide range of competitions and showcases, TEKNOFEST continues to stand out as one of the most important platforms shaping Türkiye's technological future.

Reverse Brain Drain Program

One of Türkiye's key priorities is to position itself as a global hub that attracts both domestic and international scientists. Attracting researchers trained in countries with relatively advanced technological capabilities is essential to raising the overall level of expertise in universities and across the industrial ecosystem. To this end, TÜBİTAK has launched several programs that have enabled nearly 1,200 Turkish and international researchers residing abroad to return to Türkiye and conduct their work here since 2018. Through the highly regarded International Fellowship for Outstanding Researchers and Young Researchers Program, Türkiye has attracted talent from:

- Global technology companies including Amazon, Apple, Bosch, GE, Intel, Siemens, and Volvo;
- Prestigious research institutions such as CERN, CNRS, and the Max Planck Institute;
- World-leading universities such as Harvard, Oxford, Humboldt University of Berlin, ETH Zurich, and MIT.

These programs will be expanded in the coming period to also attract experienced engineers and technical experts currently working abroad.

64. **To promote scientific collaboration among Turkic States and Islamic countries, Türkiye will lead the establishment of two regional science platforms: the Turkic States Research Area and the Islamic Countries Research Area.** These platforms will support scientific research through joint funding schemes and mobility programs, significantly advancing knowledge exchange and technology transfer among member countries. Planned projects will span a wide range of areas—from advanced materials and artificial intelligence to personalized medicine and energy efficiency—and will not only strengthen Türkiye's leadership in science and technology but also boost the R&D capacities of partner countries. These initiatives will offer international mobility opportunities to young researchers, nurture a collaborative culture, and contribute to the revitalization of scientific traditions across the Turkic and Islamic worlds. Türkiye's leadership in these efforts will upport not only its regional aspirations but also its ambition to become a global center of scientific excellence.

Goal 1. Enhancing domestic production capacity in high technologies and critical areas, and eliminating external dependency

Strategies

Strategy 1	Technology development and domectic manufacturing capacity in critical fields will be reinforced through focused initiatives such as HIT 30, Technology-Focused Industrial Move Program, project-based incentives, and financing instruments like the Advance Loans Against Investment Commitment (YTAK).
Strategy 2	Public incentive mechanisms will be employed to establish multi-partner national consortia in strategic sectors including semiconductors, nuclear technologies, biotechnology, and petrochemicals, with the goal of creating globally competitive technology enterprises.
Strategy 3	Governance models successfully implemented in the defense sector will be adapted for other sectors. The Industrialization Executive Committee will expand the scope of public procurement in priority sectors—particularly pharmaceuticals, vaccines, medical devices, rail systems, and digital transition—and a centralized Domestic Goods Fund will be created to prioritize products with a Domestic Goods Certificate in public tenders.
Strategy 4	To scale up production and exports in the defense industry, R&D and design efforts will be supported in strategically important and commercially viable areas, and assistance will be provided for mass production of products that have completed, or are close to completing, the R&D phase.
Strategy 5	Collaboration between the defense sector and other sectors—especially in health, advanced materials, and textiles—will be strengthened through talent mobility and joint projects, under the framework of dual-use technologies.
Strategy 6	Support will be extended to initiatives and investments in domestically developed generative AI models, with particular emphasis on the “Turkish Large Language Model,” and strategic partnerships with public institutions—especially TÜBİTAK—will be actively promoted.
Strategy 7	AI Transformation Programs will accelerate the adoption of AI technologies in manufacturing. Practical training will be provided to upskill the workforce and ensure successful integration of AI into business operations.
Strategy 8	R&D and investment incentives will be offered to support the design, development, and mass production of strategically critical chip types such as Field-Programmable Gate Arrays (FPGA), Application-Specific Integrated Circuits (ASIC), Power Management Integrated Circuits (PMIC), Graphics Processing Units (GPU), Communication Integrated Circuits (CIC), and AI chips.
Strategy 9	To support the automotive industry’s transition to battery, hydrogen fuel cell, and e-fuel technologies, international partnerships will be established and support for large-scale investments and R&D processes will be enhanced.
Strategy 10	Investment and research in autonomous vehicle and flying car technologies will be supported and the required technical, physical, and legal infrastructure will be developed.
Strategy 11	Targeted R&D and investment support will be provided to make Türkiye as a regional production hub for batteries and energy storage systems.
Strategy 12	Support for biotechnological and genomic research will be expanded, enabling a breakthrough in domestic capabilities in the production of active ingredients, pharmaceuticals, and medical devices.
Strategy 13	To ensure food and agricultural security, R&D and investment will be channeled into vertical farming systems, tech-driven food production, robotic agriculture, biotech agrochemicals, genetic improvement, and seed development.
Strategy 14	As part of the National Space Program, Türkiye will develop domestic space and satellite technologies and establish the legal and technical infrastructure necessary to transfer these technologies to other industries.
Strategy 15	Research in nanotechnology and materials science will prioritize high-performance composites, energy storage materials, and smart surface coatings. Efforts will be made to scale up R&D in these areas and ensure industrial uptake.

2030 INDUSTRY AND TECHNOLOGY STRATEGY

Strategies

Strategy 16	To attract global investment and build a trustworthy ecosystem, the public sector will expand its role as an anchor investor in venture capital funds. Funding opportunities will also be increased through strategic partnerships, including those with the Organization of Turkic States.
Strategy 17	Publicly supported fund-of-funds mechanisms will be broadened to support the creation of sectoral and thematic venture capital funds in fields such as biotechnology, AI, and digital transformation, and the participation of large corporations in these funds will be encouraged.
Strategy 18	Regulatory sandbox environments will be established in critical technology fields to enable the safe testing and rapid commercialization of new technologies.
Strategy 19	Under the coordination of TÜBİTAK, four research collaboration networks will be launched to promote strategic alignment and encourage joint projects between public institutions, industry, and academia in key technological areas: · HEYSEM Network: Basic Sciences and Medicine · CEZERÎ Network: Applied Sciences, Ecology, and Engineering · ARF Network: Computer Science, Artificial Intelligence, and Digitalization · BÎRÛNÎ Network: Earth, Materials, and Space Sciences
Strategy 20	National research infrastructures will be established in artificial intelligence, semiconductors/chips, genetics, quantum technologies, and cybersecurity.
Strategy 21	TÜBİTAK's research funding will be scaled up to ensure that Türkiye achieves a top-ten global position in scientific knowledge production across ten priority fields. Fields of Research: *1) Computer Sciences; 2) Environmental Sciences; 3) Energy; 4) Electrical and Electronic Engineering; 5) Pharmacology, Toxicology and Pharmacy; 6) Physics and Astronomy; 7) Chemistry; 8) Materials Science; 9) Mathematics; 10) Artificial Intelligence.*

Strategy 22	Türkiye will lead the establishment of the Turkic States Research Area and the Islamic Countries Research Area, supporting international scientific cooperation through joint research funds and mobility programs.
Strategy 23	Youth participation in the scientific, research, and innovation ecosystem will be encouraged, and the talent pool will be continuously developed through initiatives such as reverse brain drain and the recruitment of leading researchers.
Strategy 24	The Sector on Campus Program and National Technology Specialization Programs, currently being implemented under the National Technology Academy in fields like chip design, artificial intelligence, and self-driving technologies, will be expanded to include other critical technologies.
Strategy 25	The technology entrepreneurship ecosystem will be strengthened, making Türkiye a global innovation hub through initiatives such as Terminal Istanbul, GO Entrepreneurship Offices, and venture capital support schemes.
Strategy 26	R&D centers will be guided to focus on strategic and key technologies, and on priority research and innovation areas. Steps will be taken to attract the R&D centers of global companies to Türkiye.
Strategy 27	Public awareness campaigns and training initiatives will be implemented to enhance digital competencies across society, particularly in software and information technologies.

GOAL 2

Positioning Türkiye as a Leading Country of the Age of Technology Through the Transition to a Digital Economy

- DIGITAL TECHNOLOGIES
- COMMUNICATIONS INFRASTRUCTURE
- CYBERSECURITY
- BLOCKCHAIN AND FINANCIAL TECHNOLOGIES
- CLOUD COMPUTING
- OPEN-SOURCE SOLUTIONS
- INTERNET OF THINGS (IOT)
- ROBOTIC TECHNOLOGIES
- THE WORKFORCE FOR DIGITAL TRANSFORMATION
- STRATEGIES

GOAL 2

Positioning Türkiye as a leading country of the age of technology through the transition to a digital economy

Digital Technologies

65. **The transition to a digital economy requires holistic and strategic planning, with actions taken through a sector-transcending approach.** The constant development of new technologies, products, and services in the digital space presents challenges for countries navigating the digital economy transition. Achieving success in digital transition demands a clear vision, strong commitment, and collaboration among all stakeholders. Integration into the digital economy is a crucial step that will enhance Türkiye's global competitiveness, reinforce its economic independence, and elevate societal well-being. Realizing these goals hinges on the effective implementation of all components of digital transition.

Digital Turkish Lira

As the digital economy continues to grow, Türkiye is strengthening its position in both regional and global digital ecosystems through the Digital Turkish Lira Project, led by the Central Bank of the Republic of Türkiye. The first phase of the project, which has been successfully completed, involved the development of a blockchain-based retail digital currency system, server software for the Central Bank and partner banks, and a digital ID-supported mobile wallet application. Future phases will introduce offline payments, programmable payments, and hardware wallet capabilities. The Digital Turkish Lira system will also be integrated with existing infrastructures such as FAST and e-Türkiye. This system, which aims to enhance Türkiye's financial infrastructure in terms of security, cost efficiency, and agile management, will play a pivotal role in the country's digital transition and may also be utilized in innovative areas such as smart cities, micro-payments, and cross-border transactions.

66. **Türkiye is giving momentum to its digital economy transition and aims to complete the digitalization of its manufacturing sector in the near future.** In this regard, inclusive, targeted, and widespread support programs are being implemented to drive digital transition across the manufacturing industry. The SME Digital Transformation Support Program, launched in May 2024 in collaboration with KOSGEB, the European Bank for Reconstruction and Development (EBRD), TÜBİTAK TÜSSİDE, and contracted banks, alongside the Digital Transformation Support Program launched in July 2024, provides financial support to help businesses expedite their digitalization efforts. Digital transformation and digital technologies are also central to the focus areas supported under the latest calls issued by the Technology-Focused Industrial Move Program. Furthermore, a comprehensive regulatory framework has been established to address the legal and regulatory challenges businesses face during their digital transformation journey, accompanied by guidance services in this area.

67. **Türkiye is making significant strides in the areas of digital economy and e-commerce.** Digitalization is contributing to the country's economic growth and bolstering its competitiveness in global trade. Through e-commerce platforms and digital payment systems, Türkiye aims to further integrate into global markets and play a more prominent role. Investments in digital infrastructure and support for technology-based ventures are solidifying Türkiye's position in the digital economy.

KOSGEB Digital Payment System

In line with technological advancements, there is an increasing need to develop new tools that enhance the efficiency, effectiveness, and traceability of government support mechanisms, particularly by digitalizing the support payment process.

KOSGEB has transitioned all support procedures, from application to disbursement, to an electronic platform. To reinforce the support disbursement procedures in view of the requirements of digital economy and ensure the traceability of KOSGEB's support disbursements electronically, the KOSGEB Digital Application will be introduced.

As part of this initiative, the "KOSGEB Digital Wallet" will ensure that disbursements are made in accordance with designated support categories, preventing and controlling non-compliant payments. Moreover, impact analyses will be conducted to assess the effectiveness of support measures and generate recommendations for improvement.

Communications Infrastructure

68. **The first and most fundamental step in integrating into the digital economy is the establishment of a robust communications infrastructure.** 5G communication technologies enhance data transmission speeds and minimize latency, facilitating the efficient operation of digital applications. It is estimated that 5G technologies can transmit data at speeds of up to 10 gigabits per second, which is approximately 100 times faster than 4G.[11] This level of speed supports the high bandwidth and low latency requirements of next-generation technologies such as virtual reality, self-driving vehicles, and smart cities. 5G also offers the capacity to manage the massive data volumes generated by the increasing number of Internet of Things (IoT) devices. By enabling billions of IoT devices to remain simultaneously connected, 5G is fostering breakthroughs not only in industry but also in smart agriculture and healthcare services. Looking ahead, communication technologies like 6G aim to achieve terabit-level speeds per second and even lower latency, making it possible to widely deploy augmented reality (AR), virtual reality (VR), and AI-based services, while improving connection reliability and supporting the seamless integration of sensors, robots, and self-driving vehicles. Globally, the focus is shifting toward post-5G technologies that utilize high-frequency bands to enable uninterrupted connectivity anywhere, thereby making communication infrastructure future-ready and laying a dependable foundation for next-generation applications.

National Satellite Company

Türkiye has made significant progress in satellite development and production, becoming one of the few countries capable of manufacturing its own communications satellite with Türksat 6A. Currently, a number of institutions and companies—including TUSAŞ, ASELSAN, CTech, and TÜBİTAK UZAY—are actively engaged in satellite-related efforts, supported by a highly qualified and specialized workforce. The domestically developed remote sensing satellites Göktürk-2 and İMECE, along with the Türksat 6A communications satellite, are clear indicators of the country's growing capabilities in this domain.

To ensure the more efficient use of existing satellite production, testing, and infrastructure resources; to maximize the potential of technical human capital; and to prevent overlapping investments, establishing a globally competitive National Satellite Company has become a strategic imperative. This company will help unify all public entities within the satellite ecosystem under a single structure, thereby enhancing coordination and enabling more efficient use of both human and infrastructure resources. These efforts will position Türkiye as a stronger player in the global space industry and elevate its competitiveness in advanced technologies.

69. **Türkiye requires the rapid deployment of next-generation communications infrastructure.** Leading digital economies have achieved broad adoption of 5G and fiber optic technologies. Countries such as South Korea and Japan, which stand out as early movers in 5G rollout, are now actively applying this technology across industry, healthcare, education, and smart city solutions. Türkiye's fiber optic cable network has reached 577,000 kilometers, and the number of fiber broadband subscribers has grown by 15% over the past year, reaching 7.3 million. The Ministry of Transport and Infrastructure's objective of adopting 5G by 2026—using domestically developed and nationally owned technologies wherever possible—is of strategic importance.

70. **Expediting digital transition requires providing strategic support to next-generation communication infrastructure investments.** In this context, a broad support framework, ranging from public procurement mechanisms to public-private partnership models, should be designed and effectively implemented. To facilitate the deployment of international submarine fiber optic networks using domestic resources, incentive mechanisms should be expanded. In addition, the integration of terrestrial and satellite networks is essential to broaden digital coverage in rural regions. Technological advancements in digital infrastructure must be monitored proactively, with dedicated research laboratories established in pioneering fields such as secure communication channels based on the principles of quantum mechanics and terahertz communication technologies.

71. **The development of communication infrastructure should likewise prioritize technology-driven solutions that are domestically developed and nationally owned.** Türkiye possesses a robust and experienced R&D ecosystem in this field. Strategic resource allocation and the establishment of efficient public-private collaboration mechanisms will significantly accelerate the ecosystem's transition to 5G. In this regard, following the allocation of frequency spectrums, the fiber optic cabling infrastructure should be rapidly deployed in parallel with the installation of next-generation base stations. The materials and equipment used in infrastructure projects should be manufactured domestically. Beyond existing investment incentives, tailored financial instruments specific to this domain should be introduced to support manufacturers and service providers. Moreover, articulating a strong national commitment to lead in beyond-5G technologies will pave the way for securing international patents and strengthening Türkiye's position in emerging innovation landscapes.

Cybersecurity

72. **The widespread adoption of automation in industrial production has led to a rapid increase in the number of connected devices and systems, which, in turn, heightens the risk of cyber threats.** Expanding the implementation of cybersecurity measures across the industrial sector is therefore essential—not only to protect industrial automation systems from

Regional Positioning and Timing System

In pursuit of technological sovereignty and with a view to reducing dependency on foreign infrastructure, the Regional Positioning and Timing System (BKZS) will be implemented. This system, designed as a national alternative to global platforms such as GPS, will provide high-precision positioning, navigation, and timing data through Türkiye's own satellite infrastructure. BKZS will serve vital functions in a wide range of areas, including the security of military operations, the continuity of civilian communication networks, intelligent transportation systems, and precision agriculture.

Key milestones in the realization of this goal include a preliminary feasibility study, the development of atomic clocks, efforts to increase the resilience of existing systems, the implementation of a Satellite-Based Augmentation System, and ultimately, the establishment of a fully operational Regional Satellite Positioning System.

The prototype rubidium atomic clock, which has been jointly developed by TÜBİTAK NMI and TUA, is currently undergoing space qualification testing, while the CubeSat design has been finalized and the project has progressed to the subsystem production and procurement phase. These initiatives are of strategic importance for the development of domestically developed and nationally owned atomic clocks to be used in future BKZS satellites and for fostering greater contributions from private sector ventures—such as Fergani—to the national space ecosystem.

potential attacks but also to safeguard sensitive data, ensure data privacy, maintain operational continuity, and minimize physical risks to personnel and equipment.

73. **Cybersecurity strategies and investments to be developed by our country are not only technological or economic matters—they are also closely tied to national security.** Many countries are taking significant steps to protect their digital infrastructures and enhance their cybersecurity capabilities. In particular, the United States, China, and the European Union are formulating cybersecurity strategies to safeguard both public institutions and the private sector. Cybersecurity solutions to be developed using nationally owned technologies will strengthen the security of Türkiye's digital infrastructure and support its emergence as a prominent actor in the digital transition process. Accordingly, the Cybersecurity Directorate was established in January 2025 to protect the country's critical infrastructures and information systems from cyber threats, ensure national security, develop strategies, increase cybersecurity awareness, foster national and international partnerships, and lead the development of domestic technologies.

Navigation Systems and Artificial Intelligence Applications

Developing a national navigation system and domestic digital platforms such as search engines and social media, carries critical importance for strengthening technological independence, reducing external dependency, enhancing national data security, and ensuring that the economic value generated by these platforms remains within the country. Moreover, enabling these platforms to be developed by local entrepreneurs will bolster global competitiveness while further reducing reliance on external sources.

The widespread adoption of smartphones and mobile internet, combined with rapid population growth and increasing urbanization, has significantly amplified demand for such applications. In this regard, a domestic map and navigation application will be developed to address Türkiye's unique geographical, transportation, urban planning, and cultural needs. This initiative will contribute to the country's digital transition and be recognized and used internationally.

In line with the priorities of ensuring digital independence and security, protecting local users, promoting fair competition, and safeguarding infrastructure, it is planned to develop a Turkish Large Language Model and a new generation of AI-powered applications.

74. **Türkiye's position in the field of cybersecurity will be advanced through the Cybersecurity Strategy, which is built on the core pillars of "Human," "Defense," "Deterrence," and "Partnership."** Protecting the digital assets of institutions, organizations, and individuals has become one of the top priorities for governments and institutions. Cybersecurity is no longer merely a technical issue—it is now a fundamental component of national and international security strategies. The fact that a considerable portion of cybersecurity vulnerabilities stems from "human" error underscores the critical role of the individual in ensuring security. Moreover, protecting information and data in the digital world, taking proactive measures against cyberattacks, and avoiding the potential losses caused by such attacks are only feasible with a robust

national cyber "defense." Implementing effective cybersecurity measures and establishing "deterrence" against cyber threats are essential elements of security policies. Partnerships to be formed between public institutions and relevant stakeholders will make significant contributions to national cybersecurity. The Cybersecurity Strategy is designed to combat the increasing number and complexity of cyber threats around the clock, reduce risk, and strengthen Türkiye's position in the field of cybersecurity.

Blockchain and Financial Technologies

75. **The development of domestically developed and nationally owned blockchain solutions, identification of potential use cases through public-private partnerships, and evaluation of regulatory needs will give momentum to Türkiye's integration into the digital economy.** The security and transparency that blockchain technology offers will contribute to the resilience of Türkiye's digital infrastructure and support a strong global competitive position. Blockchain's decentralized and transparent architecture enables secure data storage and processing, offering particular advantages in preventing data manipulation and fraud. In addition, blockchain technologies make it possible to tokenize Real World Assets (RWAs), enabling fractional ownership and increasing accessibility, liquidity, and transparency. The United States, China, and the EU are investing heavily in blockchain R&D and applying the technology across various sectors. These applications are helping to improve efficiency in finance, healthcare, logistics, and public services through blockchain-based solutions.

76. **Blockchain has the potential to serve as a strategic instrument in the digital transition process.** With its ability to ensure data integrity and transparency, blockchain enables innovative solutions across a wide range of areas from public services to financial transactions. To improve traceability and security in supply chain processes, blockchain-based solutions should be developed. In this regard, R&D efforts to create domestic blockchain solutions and infrastructure should be supported. Led by TÜBİTAK BİLGEM, the development of national blockchain technologies will strengthen the country's autonomy and technological self-sufficiency. At the same time, legislative measures should be implemented to ensure the legal validity of smart contracts and expand their practical use.

77. **To ensure the effective deployment of blockchain technologies, Türkiye must enhance its infrastructure and capabilities.** Establishing a national test center to evaluate blockchain technologies and define security standards will provide Türkiye with significant advantages. Furthermore, raising awareness and building human capital through training programs and similar initiatives, along with encouraging academic work on blockchain at universities and research institutions, will be of critical importance.

78. **Türkiye holds the potential to become a leading global fintech hub by boosting innovation and competitiveness in financial technologies.** To this end, a participatory and transparent governance framework should be created to coordinate the efforts of various institutions and stakeholders; support should be provided to help domestic fintech startups scale; and steps should be taken to promote domestic technology procurement. In fintech, domestic initiatives offering AI- and machine learning-based solutions should be supported. In addition, investments should be made in infrastructure that would enable integration with blockchain and decentralized finance (DeFi) technologies, technical and legal frameworks should be established to ensure the secure use of crypto assets, and regulatory mechanisms should be developed to expand their use in financial services.

Cloud Computing

79. **Cloud computing infrastructure has become a key driver of digital transformation, optimizing data storage and processing capabilities.** By offering distributed computing resources, cloud technologies streamline data storage, processing, and analysis, providing significant cost savings for businesses and public institutions alike. Many countries and major corporations now place cloud computing at the heart of their digital transformation strategies, enabling more flexible and scalable business processes. Notably, the United States and European countries have become digital economy leaders through their strategic investments in cloud infrastructure. These countries have achieved both efficiency and competitiveness by extending cloud adoption across public and private sectors.

80. **Cloud computing technologies should be treated as a strategic priority within digital transition efforts, and international partnerships should be forged in this domain.** Cloud infrastructure supports data-driven decision-making and facilitates the integration of large-scale data resources across the public and private sectors. This technology offers competitive advantages, especially to SMEs, by enabling the use of advanced tools such as AI, cybersecurity, hyperscale services, and data analytics. Simultaneously, strategies to attract international expertise and experience to Türkiye will generate substantial benefits. Regulations that ensure data privacy and security will help Türkiye qualify as a trusted jurisdiction for data storage and international data transfers, thereby facilitating global partnerships. Through strategic international alliances, Türkiye can establish a broad-based cloud computing infrastructure that may also serve other countries. In this context, Large-Scale Data Centers Offering Cloud Services have been identified as one of 30 priority areas to receive support under the HIT-30 High Technology Investment Program.

81. **The effective utilization of cloud computing will be a major determinant of Türkiye's success in its digital transition.** A cloud infrastructure integrated with the communications backbone will form the foundation for the development and widespread adoption of Industrial Internet of Things (IIoT) applications. This integration will accelerate automation processes across industry and boost productivity. An advanced cloud infrastructure will also drive the digitalization of public services and enable more efficient service delivery to citizens. In this context, research and development efforts in this field will be supported, with a particular focus on developing domestically produced cloud solutions.

Open-Source Solutions

82. **Developing domestic open-source solutions will provide Türkiye with a competitive advantage on the global stage and accelerate its integration into the digital economy.** Thanks to their transparency and flexibility, open-source software significantly enhances organizational capacity for innovation. Many global companies favor such software for its adaptability and the ability to modify and build upon existing code. For instance, TensorFlow—developed by Google and released as open-source—has had a significant impact in the field of artificial intelligence and machine learning, and has been widely adopted by numerous organizations. Similarly, the Linux operating system, also open-source, powers over 95 percent of the world's web servers and forms the backbone of millions of devices globally.[12]

83. **Many countries and large companies across the globe are accelerating their digital transition efforts through open-source solutions.** Türkiye must also support and accelerate its own domestic open-source software initiatives as part of its digital transition. In addition to PARDUS, which is a national, Linux-based operating system developed by TÜBİTAK, open-source solutions will continue to be developed through strengthened educational and research e-infrastructures led by ULAKBİM and the BİLGEM Software Technologies Research Institute, ensuring institutional needs are met. Moreover, awareness campaigns targeting businesses should be carried out to increase the adoption and effective use of open-source software. Open-source-based products and services should be developed across key sectors such as public services, finance, logistics, and commerce to fully leverage the advantages this technology offers.

Artificial Intelligence Supercomputer Investment Program

To support the rapid growth of the artificial intelligence ecosystem, the Supercomputer Investment Program has been launched, resulting in the commissioning of ARF—Türkiye's most powerful supercomputer—within TÜBİTAK. ARF comprises over 80,000 processor cores, 312 GPUs, and 14 petabytes of high-performance storage, offering computing power comparable to that of 40,000 high-end laptops and opening up transformative opportunities for scientific research. In addition, TÜBİTAK provides access to the MareNostrum5 infrastructure in Spain, established under the EuroHPC Program, further enriching Türkiye's technology and research ecosystem.

A superconducting quantum computer, which is designed to integrate with ARF, is also planned for procurement. It will include a minimum of 20 physical superconducting qubits.

ARF stands as a vital infrastructure for enabling universities, public institutions, and the private sector to develop and adapt to AI technologies, and further policies and mechanisms will be introduced to broaden its use.

Internet of Things (IoT)

84. **Aspiring to become a global leader in every sphere of technology, Türkiye is taking steps to establish a secure, sustainable, and efficient national IoT ecosystem.** To that end, a national IoT Platform will be launched to enable the secure and effective management and monitoring of all IoT devices across the country. In conjunction with this platform, IoT innovation and incubation centers will be established through partnerships with leading technology firms and academic institutions. These centers will promote the research, development, and commercialization of uninterrupted IoT solutions. In addition, seamless integration between IoT devices and next-generation wireless networks will be ensured to support high-speed data transmission and real-time monitoring.

Robotic Technologies

85. **The future of industrial automation lies in robotics and collaborative robots (cobots).** These technologies are making production processes more efficient, flexible, and reliable. Cobots, in particular, offer substantial advantages in manufacturing lines due to their ability to work safely alongside humans. In line with the goal of expanding the use of robotic and cobot technologies across industry, research and development efforts related to robotics and advanced manufacturing technologies should be integrated and strengthened nationwide. As part of the HIT-30 High Technology Investment Program, advanced manufacturing technologies have been identified as a priority sector and will be supported through targeted investments and R&D initiatives.

86. **Türkiye has been making headway both as a user and a manufacturer of robotic technologies.** According to the World Robotics 2024 report, 541,302 industrial robots were installed globally in 2023, bringing the worldwide total to 4.28 million units. The electronics and automotive industries remain the largest robot consumers by sector. China, Japan, the United States, South Korea, and Germany are the five leading markets, accounting for 79 percent of global installations in 2023. The same report indicates a significant increase in Türkiye's industrial robot installations, rising from 2,800 units in 2022 to 4,400 units in 2023. These figures demonstrate the country's clear growth in the domestic industrial robotics market.

87. **Türkiye recognizes the importance of establishing a competitive robotics industry.** Accordingly, greater support will be provided for the domestic production of robotics-related software, gearboxes, motors, and motor drivers. In parallel,

Internet of Things (IoT)

The Internet of Things (IoT) refers to networks of devices that connect to the internet and communicate with one another, while the Industrial Internet of Things (IIoT) applies the IoT principles specifically within industrial sectors and practices. IIoT consists of interconnected and interoperable devices, sensors, applications, and networks that collect, transmit, and analyze data across industrial operations. Collection, transmission and analysis of such data would help improve visibility into processes, enhance monitoring, troubleshooting, and maintenance capabilities, and ultimately increase efficiency while reducing costs.

Several key prerequisites must be met to build an advanced IoT ecosystem: First, a robust infrastructure capable of delivering broadband internet and low latency is essential. For instance, the 5G technology has the capacity to offer faster and seamless connectivity between smart devices. Second, a wide range of compatible devices and sensors must be employed to meet diverse data collection and processing needs. Third, both cloud and edge computing architectures are necessary to store and process large volumes of data. Fourth, cybersecurity and data privacy are critical, requiring the protection of IoT devices and networks from cyber threats, along with safeguards for collected data. Fifth, internationally acknowledged standards and protocols must be adopted to ensure interoperability between IoT devices and systems. Open application programming interfaces are essential for seamless integration between devices and applications. Sixth, data analytics and AI technologies must be used to process the data collected from IoT devices and develop intelligent systems. Finally, clear, enforceable legal frameworks and compliance with data protection regulations are needed to guide implementation.

comprehensive training programs will be expanded to help the workforce acquire new skills and adapt to robotic and cobot technologies. Moreover, Türkiye will pursue joint R&D projects and technology transfer agreements with leading global countries in IoT and robotics. International partnerships for the exchange of knowledge and technology will help position Türkiye among the world's most competitive players in this field.

The Workforce for Digital Transformation

88. **In the transition to a digital economy, comprehensive training programs must be launched to enhance the digital competencies of the population.** Digital transformation has given rise to new professions in fields such as artificial intelligence, big data, cloud computing, and cybersecurity. To this end, vocational and technical lower- and upper-secondary

curricula should be revised in line with the national occupational standards formulated by the Vocational Qualifications Authority (VQA), ensuring alignment with the requirements of the digital economy. These updates will enable younger generations to acquire relevant competencies and plan their careers through data-driven vocational guidance services. Education platforms to be developed through public–private partnerships will broaden access to digital technologies and support individuals' participation in a flexible, continuous learning process grounded in equal opportunity. Throughout this process, the policies set out in the 2025–2028 National Employment Strategy will be implemented in an integrated manner to manage the effects of digital transformation on the labor market effectively.

89. **Programs focused on acquiring and advancing digital skills will facilitate individuals' adaptation to changing labor market conditions and strengthen their competitiveness.** New training initiatives should prioritize skills such as programming, data analytics, e-commerce management, and digital marketing to meet evolving market demands driven by digitalization. In addition, upskilling, reskilling, and advanced training programs should be introduced for employees to foster more effective use of digital tools in the workplace. It will also be advisable to accelerate Active Labor Force Program initiatives targeting the 100 professions identified by İŞKUR as future-oriented, along with other emerging occupations shaped by digital transformation. These initiatives should include the expansion of vocational training courses and on-the-job training programs. To enhance Türkiye's global competitiveness in the digital economy, it is also crucial to prioritize policies that promote the participation of women and youth in the technology sector, as part of digital transition efforts. In this way, broader segments of society will be able to adapt to digital transition, enabling the country to achieve sustainable growth in the digital economy.

Goal 2. Positioning Türkiye as a leading country of the age of technology through the transition to a digital economy

Strategies

Strategy 28	Support for fibre-optic infrastructure and next-generation communication investments will lay the groundwork for the digital transformation of industry.
Strategy 29	Public funding mechanisms will be diversified and scaled up to support enterprise-level digital transformation.
Strategy 30	Domestic production of industrial robots, additive manufacturing equipment, and other advanced manufacturing technologies will be increased.
Strategy 31	National solutions, including a domestically developed operating system, will be created for digital platforms such as navigation systems, search engines, social media, messaging services, and payment platforms, and efforts will be made to promote their widespread use.
Strategy 32	The necessary technical and legal frameworks will be established to enable integration with technologies such as blockchain, decentralized finance (DeFi), crypto-assets, and the tokenization of real-world assets, as well as to facilitate the development of domestic alternatives in these domains.
Strategy 33	With a focus on domestic technology-driven financial solutions, Türkiye will become a global fintech hub.
Strategy 34	Research and development incentives and investment support will help accelerate digitalization across the agriculture, services, and transportation sectors.
Strategy 35	Cybersecurity solutions developed using domestically developed and nationally owned technologies will bolster Türkiye's digital infrastructure—including manufacturing systems—against cyber threats.

Strategy 36	Investments in large-scale data centers and cloud computing infrastructure will be supported, while international strategic partnerships in this field will help Türkiye build the capacity to serve regional markets.
Strategy 37	To accelerate the transition to a digital economy, the development and adoption of open-source software will be encouraged.
Strategy 38	A secure, sustainable, and efficient national Internet of Things (IoT) ecosystem will be established.
Strategy 39	Digital transformation interfaces offering enterprises services such as digital maturity assessments, strategic planning, consultancy, training, and access to finance will be expanded.
Strategy 40	Digital transformation of public services for industry will be expedited, with efforts focused on diversifying the digital services provided by the public sector. Automation of business processes will be promoted while enhancing service quality.
Strategy 41	The current and potential impacts of digital transformation on the workforce will be analyzed systematically, and policies will be developed to maximize social gains and minimize associated costs.
Strategy 42	Digital skills development programs and lifelong learning opportunities will be expanded to continuously strengthen the digital competencies of human capital.

GOAL 3

Reducing Industrial Carbon Emissions Through the Shift to a Green and Circular Economy

EUROPEAN GREEN DEAL
GREEN TRANSITION SUPPORTS
GREEN TRANSITION OF INDUSTRIAL ZONES
RENEWABLE ENERGY TECHNOLOGIES
NUCLEAR ENERGY TECHNOLOGIES
GREEN LABOR MARKET
STRATEGIES

GOAL 3

Reducing industrial carbon emissions through the shift to a green and circular economy

European Green Deal

90. **The European Union, Türkiye's largest trading partner, has committed under the European Green Deal to reducing greenhouse gas emissions by at least 55% by 2030 and introduced the Carbon Border Adjustment Mechanism (CBAM).** This mechanism is designed to maintain the EU's competitiveness amid the costs of the green transition and to prevent the relocation of production to countries with less stringent emission targets. The CBAM, which entails carbon pricing for the import of carbon-intensive products into the EU, will be gradually implemented starting from 2026 across sectors including iron and steel, aluminum, fertilizer, cement, hydrogen, and electricity generation. In response, Low-Carbon Roadmaps have been developed for the aluminum, steel, fertilizer, and cement sectors, which together account for approximately 13% of Türkiye's exports to the EU, aiming to reduce greenhouse gas emissions in line with national targets. These roadmaps, aligned with Türkiye's 2053 emission reduction goals, target a 75% reduction in aluminum, 99% in steel,

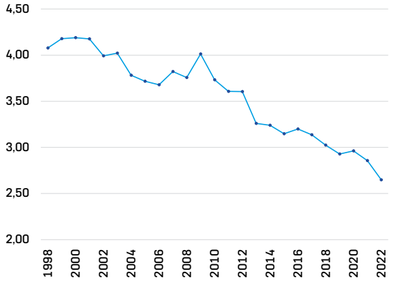


Figure 4: Greenhouse Gas Emission Intensity Index[13]
(Total Greenhouse Gas Emissions (million tons) / GDP (index))
Source: TurkStat, Environmental and Energy Statistics, National Accounts.

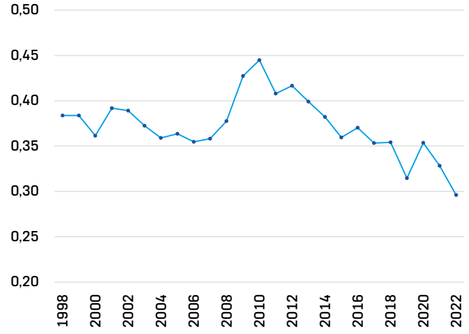


Figure 5: Industrial Greenhouse Gas Emission Intensity Index
(Greenhouse Gas Emissions from Industrial Processes and Product Use [million tons] / Manufacturing Industry GDP [index])
Source: TurkStat, Environmental and Energy Statistics, National Accounts.

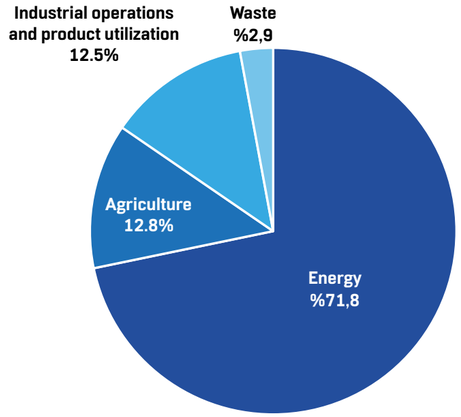


Figure 6: Sectoral Distribution of Greenhouse Gas Emissions in 2022
Source: TurkStat, Environmental and Energy Statistics.

and 93% in cement, while aiming for net-zero emissions in the fertilizer sector. To accelerate the implementation of the actions outlined in these roadmaps, a comprehensive investment plan will also be introduced. In a major step towards achieving its 2053 net-zero targets and broader climate and sustainable development objectives, the Ministry of Industry and Technology launched the "Türkiye Industrial Decarbonization Investment Platform (TIDIP)" initiative in November 2024. Meanwhile, as of June 2024, the Ministry of Trade has implemented the "Responsible®" Program, offering consultancy services to exporters and manufacturers, and granting the right to use the "Responsible®" label to companies that meet defined sustainability criteria.

91. **Preparations should also be made for a potential expansion of CBAM's sectoral scope.** The long-term objective of CBAM is to prevent carbon leakage. Including additional sectors in the mechanism would support the EU's climate targets and broaden its overall impact. The Fit for 55 package underpins CBAM through complementary regulations on energy efficiency, renewable energy, the ETS, and others, which indicates that CBAM may cover more sectors in the future. To further enhance its effectiveness and prevent carbon leakage, it is expected that CBAM will gradually be extended to include energy-intensive sectors such as textiles, automotive, and chemicals. It should also be noted that other countries, including the United Kingdom, are in the process of implementing their own systems and mechanisms.

The European Union's Green Transition Agenda

The European Green Deal (EGD), announced in December 2019, is a comprehensive and ambitious plan aimed at redefining the European economy and society. The EGD seeks to transform the EU into a modern, resource-efficient, and competitive economy, achieve net-zero greenhouse gas emissions by 2050, decouple economic growth from resource use, and ensure that no person or region is left behind.

The EGD consists of eight vertical and two horizontal (supporting) pillars: 1) Setting ambitious targets 2) Ensuring secure and clean energy 3) Steering industry toward a circular economy 4) Protecting ecosystems 5) Achieving a toxic-free environment 6) Promoting safe and sustainable food 7) Encouraging smart and sustainable mobility 8) Advancing energy-efficient buildings and renovations 9) Financing the transition 10) Ensuring a just transition.

Under the European Climate Law, the EU has pledged to reduce net greenhouse gas emissions by 55% by 2030 compared to 1990 levels. To achieve this target, the **"Fit for 55"** legislative package has been introduced, comprising 15 proposals including the reform of the Emissions Trading System (ETS), the Renewable Energy Directive, and the Carbon Border Adjustment Mechanism (CBAM). Following the adoption of the final two proposals in October 2023, the EU now has legally binding climate targets across all key sectors.

In the framework of the EGD, a range of sectoral and thematic strategies, instruments, measures, and regulatory frameworks have been developed—from the Biodiversity Strategy to the Battery Alliance. The green transition of European industry has been defined as one of the core pillars of the New Industrial Strategy (2020) and its updated version (2021). Launched in 2020, the new Circular Economy Action Plan includes 35 actions that consider the entire life cycle of products and aim to make sustainable products the norm across the EU. The REPowerEU Plan, introduced in May 2022, provides guidance to the EU on saving energy, diversifying energy sources, and generating clean energy. In February 2023, the Green Deal Industrial Plan was announced to strengthen the EU's green technology manufacturing capacity. As part of this plan, the Critical Raw Materials Act was proposed to reduce import dependency on essential elements for green technologies, including lithium, gallium, cobalt, and nickel. At the same time, the Net-Zero Industry Act (NZIA) was proposed to streamline the regulatory framework, mobilize financial resources, develop green skills, and enhance cooperation. On 6 February 2024, EU legislative bodies reached an agreement on the NZIA.

92. **Reducing greenhouse gas emissions in the automotive sector is of critical importance for environmental sustainability and climate change mitigation.** To this end, the EU has introduced emission directives that place increasing pressure on automakers by tightening emission standards. In Türkiye, Regulation (EC) No 715/2007, which is aligned with EU legislation, is currently in force. Under this regulation, vehicles must be certified in accordance with Real Driving Emissions (RDE) tests before being placed on the market. In addition, Regulation (EU) 2019/631, which targets reductions in CO2 emissions from passenger cars and light commercial vehicles, stipulates that the average CO2 emissions of new vehicles must fall below 95 g/km as of 2021. Manufacturers that fail to meet these targets face substantial financial penalties for each gram of CO2 exceeded, multiplied by the number of vehicles sold. These limits are planned to be further tightened in 2025 and 2030. Moreover, the EU provides significant incentives to producers of electric and ultra-low-emission vehicles through super-credit and pooling mechanisms, enabling companies to lower their fleet averages and gain an advantage in reaching their emission targets. In Türkiye, practices such as special consumption tax (ÖTV) reductions or exemptions for electric vehicles have been introduced to support end users.

Green Transition Supports

93. **A wide range of support programs have been introduced to facilitate the green transition in industry.** The Ministry of Industry and Technology supports various projects and investments to advance the objectives of green transition and sustainability. Between June 2012 and June 2024, investment incentive certificates were issued for 14,003 renewable energy generation projects, with a total investment volume of TRY 1.1 trillion. In the same period, 145 projects involving the production of turbines, generators, and photovoltaic solar panels for renewable energy received incentives, amounting to approximately TRY 50 billion in total investment. Within the scope of Project-Based Investment Incentives, large-scale projects contributing to green transition and sustainability goals are supported. Incentive certificates have been issued for projects including hybrid engine production, electric vehicles, electric vehicle batteries, photovoltaic solar panels, metal recycling, and recycled polymers.

94. **The Türkiye Green Industry Project is designed to support the sustainable and efficient green transition of industry.** Coordinated by the Ministry of Industry and Technology and financed by the World Bank, the project is implemented in partnership with KOSGEB and TÜBİTAK. Launched on 1 August 2023, the six-year project has a total budget of USD 450 million. Through this initiative, industrial enterprises receive technical assistance and investment financing in areas such as renewable energy, resource efficiency, and sustainability. TÜBİTAK is responsible for the R&D component of the project, which has a budget of USD 175 million, and supports projects related to the green transition of industry through dedicated calls. In 2024, approximately TRY 1 billion was allocated to 124 approved R&D projects. The program also helps raise awareness and prepare roadmaps for green transition by offering mentoring services, particularly for SMEs. In 2024, mentoring support was extended to 150 projects from 126 SMEs.

95. **The Green Transition Support Program, coordinated by the Ministry of Industry and Technology, aims to support investments aligned with the principles of the circular economy, preserving natural resources, contributing to climate**

and sustainability goals, and promoting resource-efficient and low-carbon production. The program was developed to encourage enterprises in the manufacturing industry to adopt environmentally friendly and sustainable production models, and improvements related to green transition are classified as priority investments. It supports the green transition of industrial facilities regardless of enterprise size, covering resource efficiency, energy efficiency, water efficiency, waste management, carbon and water footprints, and recovery practices. Applicants must submit a green transition roadmap covering a minimum of five years and establish a green transition team. Enterprises deemed eligible for support under the program are awarded the title of "Green Transition Center."

Green and Digital Transition Centers

The European Green Deal, introduced by the European Union—Türkiye's largest trading partner—places binding obligations on industrial enterprises to reduce carbon emissions. To maintain the competitiveness of Turkish exporters to the EU, the Ministry of Industry and Technology has launched Green and Digital Transition Support Programs to promote green and digital transitions (twin transition). Applicants are required to submit a roadmap identifying their needs and plans for green and digital transition. Enterprises whose roadmaps are approved and who qualify for support under the programs are granted the title of Green Transition Center or Digital Transition Center. These centers are positioned as key actors in the twin transition of industry. They are expected to guide Turkish industry toward sustainable production models by promoting green and digital transition.

96. **TÜBİTAK continues to support the R&D and innovation ecosystem in fields related to green transition and climate change.** Following Türkiye's declaration of the "2053 Net Zero Emissions Target" in 2021, TÜBİTAK published a guide outlining priority R&D and innovation areas aligned with the European Green Deal, and began prioritizing support for related projects. In 2022, the Science and Technology Commission of the Climate Council was convened, and in 2023–2024, Green Growth Technology Roadmaps were prepared for the iron-steel, aluminum, cement, fertilizer, chemicals, and plastics sectors to identify Türkiye's technological needs in relation to green transition and climate change mitigation. Accordingly, R&D and innovation projects that aim to meet these needs through domestic technologies are prioritized for support.

Collaborative, platform-based support mechanisms are also key instruments in advancing the green transition. Under the TÜBİTAK 1004 High Technology Platforms Program, projects such as the Türkiye Photovoltaic Technology Platform, "Advanced Nanotechnology for a Sustainable Circular Economy," "Battery Technologies for Electric Vehicles," "Sustainable Advanced Vehicle Technologies," "Advanced Technologies for Sustainable Cities," and the "Sustainable Agricultural Technologies Platform" receive support. Within TÜBİTAK's Industrial Innovation Network Mechanism (SAYEM), innovation networks such as "Smart Cities" and "Smart Home" are also supported to contribute to the green transition. In addition, TÜBİTAK's Marmara Research Center conducts sector- and facility-specific resource efficiency analyses focused on climate change and sustainability, prepares sectoral greenhouse gas inventories, and evaluates the vulnerability of Türkiye's water, agriculture, and industry sectors using climate projections, providing data and insights to inform decision-makers.

Green Transition of Industrial Zones

97. **Organized Industrial Zones (OIZs) play a crucial role in reaching zero-emission targets.** With the inclusion of the "Green OIZ" concept in OIZ Law No. 4562, measures such as resource and energy efficiency, lean production, industrial symbiosis, and environmentally friendly practices are being promoted in industrial zones. As of March 2025, 17 OIZs have received certification as "Green OIZs." These zones, certified by the Turkish Standards Institution (TSE), must meet a series of environmental, economic, social, and managerial criteria. Projects that fulfill these criteria are prioritized by the Ministry of Industry and Technology. The Green OIZ approach positions industrial zones as drivers of resource and energy efficiency, reduced carbon emissions, and minimal environmental impact in industrial production. Accordingly, eco-friendly production methods are being implemented in industrial zones, and waste management and recycling practices are becoming increasingly widespread. To accelerate the green transition of industrial areas, green logistics and transportation systems—particularly rail transport—are being integrated into industrial zones.

98. **Energy efficiency and waste management are central to the green transition in industrial zones.** In an effort to increase energy efficiency, across industrial zones, renewable energy adoption is encouraged and energy management systems are established in industrial facilities. These systems monitor and optimize energy consumption, reducing costs and enhancing environmental sustainability. Integrating renewable energy sources represents a major step toward the long-term sustainability of industrial zones. Moreover, upgrading treatment infrastructure and expanding recycling and wastewater reuse practices are essential for unlocking Türkiye's full potential in transitioning to a circular economy.

Türkiye Organized Industrial Zones Project

The Türkiye Organized Industrial Zones Project, launched under a EUR 250.3 million loan agreement signed with the World Bank on 26 February 2021, aims to transform OIZs into "green/sustainable production areas" and contribute to a greener, more competitive Turkish industry. Subprojects approved by the Ministry of Industry and Technology and included in the Investment Program are financed with an interest/profit share rate of 3% over 13 years, including a three-year grace period. This is carried out in accordance with the "OIZ Implementation Regulation" and the "Principles and Procedures on the Use and Financing of Appropriations for OIZ and Industrial Site Projects."

The project's development goal is to enhance the efficiency, environmental sustainability, and competitiveness of Türkiye's Organized Industrial Zones.

Supported investment areas include:

- Wastewater treatment plants
- Wastewater recovery and reuse facilities
- Solar power plants (SPPs)
- Green buildings
- Digital transformation
- Infrastructure
- SCADA systems
- Environmental laboratories
- Integrated communication and security systems

A total of 37 OIZs have been granted credit support under the project. By the end of the project, the following key outcomes are targeted:

- Annual energy savings of 27,932 MWh through basic and green infrastructure investments
- Annual water savings of 6,628,000 cubic meters through green investments
- Annual reduction of 18,434 metric tons of CO_2 emissions as a result of supported projects
- 29,200,000 cubic meters of wastewater treated through new or improved facilities

Renewable Energy Technologies

99. **The world has come to recognize that the shift towards renewable energy sources is not only a means of combating the climate crisis, but also a strategic necessity.** The ongoing conflict between Russia and Ukraine since 2022 has, much like the 1973 OPEC crisis, underlined the critical importance of energy security, particularly across Europe. Europe's dependence on Russian natural gas, coupled with high energy demand, has revealed the extent of the region's vulnerability to global shocks in the energy market. In response, the EU has begun to develop more comprehensive policies to diversify energy sources and accelerate the transition to renewable energy technologies. The European Commission's REPowerEU initiative is designed to end dependence on Russian fossil fuels before 2030. In addition, the EU Green Deal Industrial Plan, introduced in 2023, seeks to increase production capacity in renewable energy technologies.

100. **Türkiye has identified green energy as a strategic priority within a broad governance framework that includes the Ministry of Energy and Natural Resources, the Ministry of Industry and Technology, the Ministry of Environment, Urbanization and Climate Change, the Ministry of Trade, and the Ministry of Transport and Infrastructure.** To mobilize natural, human, and technical dynamics in this field and to build capacity, numerous plans, programs, strategies, and legal regulations have been introduced. Green energy has been designated as one of the seven priority sectors under the HIT-30 High Technology Investment Program. Within this framework, the following areas have been defined as key priorities: green hydrogen production, electrolyzers, wind energy systems, solar energy cells, wafers and ingots, batteries for energy storage, battery components (including cathode active materials, electrolytes, and separators), and the processing of critical minerals for high technology applications.

101. **Global energy supply disruptions and rising energy prices have led to significant shifts in Türkiye's energy policies.** To reduce dependence on imported energy, investments are being made in renewable energy sources and projects are being developed to improve energy efficiency. These strategies not only enhance the country's energy security but also help reduce energy costs. With its considerable potential in this field, Türkiye is well positioned to become one of the world's leading renewable energy exporters.

102. **Türkiye is strengthening its production and technology development capabilities for alternative energy sources, particularly renewable ones.** As of the end of 2024, more than half of the country's installed capacity—totaling 115,390 MW—is based on renewable energy sources. The number of power generation plants has reached 33,303, including 764 hydroelectric, 369 wind, and 31,224 solar plants. Installed solar power capacity has exceeded 19 GW.[14]

103. **Together with wind energy, solar power has become the fastest-growing renewable energy source in terms of global capacity expansion.** According to 2022 data from the International Energy Agency (IEA), solar panels account for 4.5% of global electricity generation from renewables, ranking third after hydro and wind.[15] Despite supply chain bottlenecks, high commodity prices, and rising interest rates, solar panels alone accounted for three-quarters of the global renewable capacity additions in 2023. Capacity growth is expected to continue in the coming period, with solar and wind energy projected to comprise 96% of these increases.

104. **Türkiye aims to raise its solar power generation capacity to 80 GW by 2035 and currently ranks first in Europe and third globally in solar panel production. The country possesses the capability and capacity to ensure that all domestic solar power plants use domestically manufactured panels.** Moreover, Türkiye holds significant potential to meet Europe's projected additional demand of 400 GW in solar panels by 2030. Beyond panel production, a critical issue is

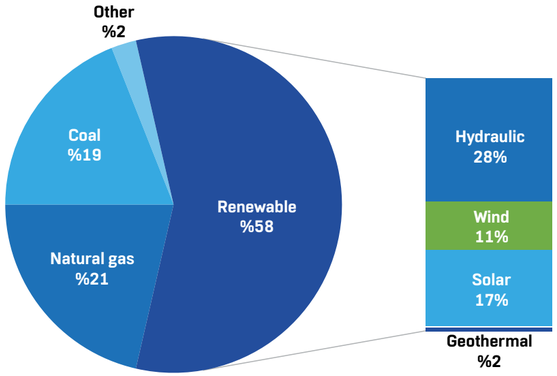


Figure 7: Türkiye's Installed Capacity by Energy Source
Source: MoENR Information Center

the domestic manufacturing of photovoltaic cells—the fundamental component of solar panels. Domestic production of solar cells should not be limited to conventional silicon types but should also explore emerging technologies such as perovskite or multi-junction cells. In addition to cell technologies, efforts should be made to produce thin-film solar panels that can be applied to various surfaces, and to develop Building-Integrated Photovoltaic (BIPV) technologies that allow for integration into structural components.

105. **Notable capacity increases are also expected in wind energy in the near term.** As of the end of 2024, Türkiye's installed wind capacity stands at approximately 13 GW. The Twelfth Development Plan targets an increase to 18 GW by 2028, and the Energy Transition and Renewable Energy 2035 Roadmap foresees a combined wind and solar capacity of 120 GW by 2035. Meanwhile, updated data from Türkiye's Wind Energy Potential Atlas indicate that the country has the potential to install approximately 100 GW of wind capacity, which could increase to 150 GW with technological advancements.[16]

106. **Türkiye must continue to strengthen its global competitiveness in wind turbine component manufacturing.** China is expected to maintain its position as the largest production hub for all major wind energy components in the medium term, with a share of 60% to 80% of global production capacity. Türkiye has already established a production base with a high degree of domestic content, supported by various mechanisms, and is exporting wind energy components. Capabilities in the production of towers, blades, and generators have placed Türkiye among the top five countries in Europe for wind turbine component manufacturing. Further progress is also needed in the domestic production of key

materials, such as neodymium-iron-boron (NdFeB) magnets used in generators, the development of magnesium diboride (MgB_2) superconductors that offer cost-effective grid integration solutions, and the technical capacity required for turbine maintenance and operation. Globally, about 93% of installed wind energy capacity is located onshore.[17] While the height of onshore turbines and wind speed face certain constraints, offshore turbines are not subject to the same limitations. This has accelerated the development of floating offshore wind turbines, especially for deeper waters. The HIT-Wind call under the HIT-30 Program has been launched from this perspective. Technological innovations are focusing on the development of turbines with larger rotor diameters and greater efficiency. Accordingly, R&D and innovation efforts, particularly in blade design, should aim to maximize energy yield from turbines.

Hydrogen

Hydrogen, the most abundant element in nature, can be produced through various processes using fossil fuels, nuclear energy, or renewable energy sources. Currently, hydrogen is mostly consumed at the site of production due to the still highly limited infrastructure for its transport and storage. As demand for hydrogen increases and its use becomes more widespread, there is a growing need to develop infrastructure that connects production and consumption centers.

Hydrogen can be used directly as a fuel, to generate electricity and heat through fuel cells, or as a feedstock in chemical processes, making it a highly versatile energy carrier. Fuel cells are electrochemical systems that produce electricity and heat from hydrogen, with water being the only by-product. Different types of fuel cells exist, depending on the characteristics of the electrolyte used. For instance, PEM fuel cells operate at low temperatures, can respond rapidly to varying power demands, and offer compactness, light weight, and high power density, making them strong candidates for widespread use in mobility applications.

Hydrogen holds significant potential in reducing carbon emissions and enhancing energy security.

It also offers an effective solution for storing energy, particularly in the context of integrating variable renewable energy sources into the grid. Currently, hydrogen is mostly produced from fossil fuels, which results in considerable carbon dioxide emissions. Cleaner methods of hydrogen production are urgently needed. According to 2022 data from the International Energy Agency, 70% of the energy used for global hydrogen production came from natural gas and about 30% from coal, while low-emission hydrogen accounted for less than 1% of total production. Green hydrogen produced with renewable energy can play a vital role in decarbonizing priority sectors such as long-distance freight transport, as well as the transport and iron-steel industries. Electrolyzers, which work in reverse of the fuel cell process, are electrochemical systems that split water into hydrogen and oxygen using electricity. Establishing electrolyzer capacity powered by renewable energy sources is essential for ensuring a supply of green hydrogen.

107. **To unlock the potential in this field and activate the green hydrogen ecosystem, new incentive and support models are being developed.** In this context, new instruments and structures developed on the international stage are being examined, and a new support model is under development. In its initial phase, this model is expected to be open only to consortia. Globally—and especially across Europe—the valley concept has emerged as a new clustering model involving specific commitments and the development of business models. Türkiye's first Hydrogen Valley, the South Marmara Hydrogen Coast – HYSouthMarmara project, has been awarded an EUR 8 million grant under the Horizon Europe Clean Hydrogen Partnership call. The project, which commenced on 1 July 2023, will provide for the annual production of 500 tons of green hydrogen.

National Hydrogen Program

In the transition toward a low-carbon economy, hydrogen energy offers a strategic opportunity for Türkiye. To this end, a National Hydrogen Program will be launched, with the production of "green hydrogen" from renewable sources placed at its core. The program will address the integrated production, storage, transport, and industrial use of hydrogen.

In the initial phase, electrolysis facilities powered by solar and wind energy will be established, and pilot production zones will be created. In energy-intensive industries such as iron and steel, petrochemicals, and fertilizers, the use of hydrogen as a substitute for fossil fuels will be promoted. Moreover, the use of hydrogen in the transport sector, particularly in fuel cell vehicles and heavy-duty transport, will be supported.

The capacity of the domestically developed electrolyzer system by TÜBİTAK will be expanded to become a globally competitive product. Green hydrogen investments in Türkiye will be encouraged to use domestically produced electrolyzers.

Standards will be established for the safe transport of hydrogen and for the development of infrastructure systems, and a legal and technical framework will be created. At the same time, domestic industry will be supported in developing the competence to produce hydrogen systems and storage solutions tailored to various applications, thereby creating a domestic supplier ecosystem.

The National Hydrogen Program will play a critical role in Türkiye's energy transition, strengthening industrial competitiveness, reducing dependence on external sources, and laying the foundation for a new energy economy with strong export potential.

108. **Developing domestically produced electrolyzers for green hydrogen production is of paramount importance.** To meet Türkiye's electrolyzer capacity targets of 2 GW by 2030, 5 GW by 2035, and 70 GW by 2053, the ongoing development work as of 2024 will be completed in the coming period. In parallel, qualified human resources will be cultivated, and the supporting industries necessary for producing electrolyzer subcomponents will be promoted. To this end, support mechanisms will be introduced to integrate renewable energy sources with hydrogen production.

109. **Hydrogen technology strategies must also include the development of carbon capture, utilization, and storage (CCUS) technologies.** These technologies are critical for reducing emissions from industrial processes and ensuring the efficient use of carbon. Türkiye envisions meeting part of its hydrogen demand through blue hydrogen while transitioning from fossil fuels to green hydrogen in carbon-intensive industries. For instance, reducing iron with hydrogen will enable the production of green steel and boost export potential in this area. In parallel, the aim is to develop hydrogen storage systems using domestic materials for storing and transporting hydrogen in gas or liquid form. This includes the development of boron-based compounds, in addition to chemical and metal hydride materials for storage, as well as the synthesis of materials to be used within the system and the execution of performance testing. Advancements in these technologies will help scale up the use of hydrogen energy and enhance its commercial viability.

Nuclear Energy Technologies

110. **Nuclear energy plays a vital role for Türkiye in the development and domestic production of strategic materials, as well as in supporting energy security, economic growth, national defense, scientific advancement, and the 2053 net-zero emissions target.** Nuclear energy is critical to both increasing Türkiye's energy security and reducing carbon emissions. It also offers a sustainable energy solution that lessens dependence on fossil fuels and promotes energy independence. Moreover, it contributes high value-added products, supporting R&D and innovation.

111. **The commissioning of the Akkuyu Nuclear Power Plant (NPP) units will mark a major leap in Türkiye's national capabilities in this field.** The plant, with a total installed capacity of 4,800 MW across four units, is equipped with the most advanced systems in terms of nuclear technology and safety. Its first unit is expected to be operational in 2025. Once fully operational, the Akkuyu NPP is projected to generate 35 billion kWh of electricity annually, preventing 35 million tonnes of carbon dioxide emissions and reducing natural gas imports by 7 billion cubic meters. Experience gained from the plant has already expedited the development of nuclear technologies in Türkiye and initiated groundwork for the construction of additional plants. As of the end of 2024, the number of Turkish engineers working at Akkuyu NPP is expected to exceed 350, which is an encouraging sign of Türkiye's progress in this area.

Domestic Nuclear Reactors

Nuclear energy is a strategic component in building an energy infrastructure that supports sustainable economic growth, reduces dependence on external sources, and strengthens high value-added industrial production in Türkiye.

Given the country's growing energy demand, which is fueled by the proliferation of new technologies, including artificial intelligence, it is essential for Türkiye to tap into nuclear energy as a reliable, high-density, clean energy source. From this perspective, the nuclear energy journey launched with the Akkuyu NPP will be accelerated through the development of domestic nuclear reactors. Investments will be designed to maximize domestic production of reactor equipment and infrastructure components.

To this end, reactor development will be supported under the Pre-Competitive Partnership Program. Long-term projects will be transitioned to the investment stage following R&D phases, through project-based incentives. Industrial clustering in nuclear technology will be encouraged, and domestic supply chains will be created in strategic areas such as reactor equipment, automation systems, heat exchangers, pressure vessels, and safety equipment. Developing new-generation nuclear technologies, such as molten salt reactors, will enable Türkiye to be at the forefront in the face of potential future disruptions. Türkiye will treat nuclear energy not merely as a source of electricity, but as a strategic lever for technological and industrial advancement, thereby boosting its competitiveness and integration into the global value chain.

112. **Among Türkiye's key priorities is the development and integration of innovative nuclear energy technologies, particularly Small Modular Reactors (SMRs), into the national energy strategy.** A roadmap for fourth-generation nuclear reactors will be drawn up, and steps will be taken to build national capabilities and export potential across the entire life cycle including design, manufacturing, construction, installation, operation, maintenance, repair, decommissioning, and fuel cycle. Moreover, the production and deployment of mobile nuclear reactors will be explored. SMRs offer advantages over traditional nuclear power plants, including lower capital investment, site flexibility, and modular construction. They can quickly respond to electricity demand with shorter construction times and lower initial costs. Hybrid energy systems combining SMRs with renewable power plants can contribute significantly to decarbonization goals through co-generation applications such as hydrogen production, process heat, desalination, and district heating. To commercialize SMR technologies, Türkiye is developing innovative business models and regulatory frameworks that ensure deeper involvement of domestic industry.

Nuclear Technopark

To consolidate the R&D and innovation ecosystem in key areas such as nuclear sciences, radiation technologies, and materials research, a Nuclear Technopark will be established. The technopark will coordinate the infrastructure and human resources of relevant public institutions, particularly TÜBİTAK and Turkish Energy, Nuclear and Mineral Research Agency (TENMAK), and support academic staff at universities as well as private sector initiatives.

With its longstanding background in nuclear energy, Istanbul Technical University is expected to assume academic leadership at the Nuclear Technopark.

The technopark is intended to expand Türkiye's nuclear technology capabilities, strengthen university-industry collaboration, and serve as a hub for advanced R&D. It will also promote the development of innovative projects in nuclear sciences and associated engineering fields.

113. **Nuclear power plants not only strengthen energy supply security but also offer significant economic, industrial, and technological advantages.** Given the high initial investment costs of establishing reactors, it is of critical importance that Turkish companies gain experience by participating in domestic projects. Such experience will, in the long term, pave the way for Turkish firms to serve as suppliers in international nuclear power plant initiatives.

Green Labor Market

114. **Within the green transition process, cultivating a workforce equipped with sustainability-oriented skills has become an inescapable need.** This ongoing transformation across all sectors is giving rise to new occupational fields that may replace conventional jobs. However, individuals lacking green skills face a heightened risk of being negatively impacted by this transition. In an effort to address the requirements of green transition, vocational and technical secondary education curricula must be restructured to focus on areas such as renewable energy, energy efficiency, sustainable agriculture, and the circular economy. Within this framework, students should be equipped with the skills needed for environmentally friendly production processes and effective resource management. Lifelong learning initiatives should aim to strengthen individuals' green skillsets while also enhancing their environmental consciousness. Educational plat-

forms to be developed through public–private partnerships can foster inclusive access to knowledge related to the green economy, reaching all segments of society. Through these platforms, best practices at both the national and international level can be shared, and sectoral awareness can be broadened. Efforts coordinated by the Ministry of Labor and Social Security to ensure a just transition to a green economy will further accelerate this process.

115. **The green transformation of the labor market must be supported through the development of 'green-collar' professions and the expansion of training opportunities for specialization in these areas.** National strategies should be formulated to increase the appeal of professions such as sustainability expert, renewable energy technician, sustainable construction specialist, environmental management consultant, and circular economy expert. Targeted programs should be introduced to reskill the current workforce in line with green transition needs, while employers should receive financial and technical support throughout this process. In addition, innovative, environment-focused projects within universities and research centers should be promoted to support the development of green technologies. In this context, the outcomes of studies conducted to define pathways for inter-occupational mobility in Türkiye will strengthen the implementation-oriented policies pursued particularly by İŞKUR and the Ministry of National Education. This process will not only contribute to Türkiye's achievement of its sustainable development goals but also help position the country more strongly within the global green economy. As part of the green transition, the establishment of a society that is attentive to resources, savings, and efficiency is of critical importance for maintaining a balance between economic growth and environmental sustainability.

Goal 3: Reducing industrial carbon emissions through the shift to a green and circular economy

Strategies

Strategy 43	Through the adoption of regulations aligned with the European Green Deal, the industrial sector's carbon footprint will be reduced; the necessary technical and legal frameworks will be implemented to ensure compliance with the Carbon Border Adjustment Mechanism (CBAM).
Strategy 44	Support mechanisms will be diversified and scaled up to encourage the adoption of low-carbon production methods and circular economy principles in industrial enterprises. Platforms such as TIDIP will be utilized to promote investment in low-carbon technologies.
Strategy 45	The green transformation of planned industrial areas, particularly organized industrial zones (OIZs), will be financed through larger-scale and more favorable funding programs; the number of Green OIZs will be increased.
Strategy 46	A 100% domestic production capacity in solar energy technologies will be achieved, primarily through investments aimed at expanding solar cell manufacturing capabilities.
Strategy 47	Support will be provided for both investments and R&D initiatives targeting the domestic production of key components of wind turbines and the deployment of offshore and high-capacity onshore wind turbines.
Strategy 48	Investments and research activities aimed at activating the green hydrogen ecosystem—particularly in electrolyzer, fuel cell, and storage technologies—will be promoted.
Strategy 49	Domestic solutions in carbon capture, utilization, and storage (CCUS) technologies will be developed and deployed in industrial facilities; captured carbon will be repurposed as a raw material in the production of fuels, chemicals, and minerals.

Strategy 50	AI-supported systems will be established to enable the integration and stabilization of green energy technologies within the national grid.
Strategy 51	In energy supply planning, priority will be given to renewable sources alongside nuclear energy; investment in nuclear technologies will be rapidly scaled up.
Strategy 52	Industrial facilities will be granted preferential access to green and nuclear energy sources to minimize energy costs and enhance supply security.
Strategy 53	Uninterrupted energy supply in the industrial sector will be ensured through smart grid systems and advanced energy storage solutions.
Strategy 54	The transition to energy-efficient technologies in industrial plants will be supported; mandatory energy management systems will be introduced to improve energy efficiency.
Strategy 55	The number, capacity, and technological quality of wastewater treatment infrastructures in industrial areas will be increased; greywater recycling systems and other water-saving industrial practices will be expanded, particularly within OIZs, to boost water efficiency.
Strategy 56	Modernized waste management systems will be implemented, starting with the chemical, metal, and textile sectors, to support the recovery of industrial waste and the production of high value-added secondary raw materials.
Strategy 57	In order to expand green employment and align existing workflows with the green transition, inclusive education and competency-building programs will be implemented to accelerate the transformation of both society and human capital.

GOAL 4

Promoting Integration Into Global Markets and Boosting Competitiveness

SHIFTS IN THE GLOBAL ECONOMIC LANDSCAPE

LOGISTICS AND SUPPLY CHAINS

NON-TARIFF BARRIERS

CRITICAL RAW MATERIALS

INDUSTRIAL AND TECHNOLOGY DIPLOMACY

STRATEGIES

GOAL 4

Promoting integration into global markets and boosting competitiveness

Shifts in the Global Economic Landscape

116. **The global economy has undergone significant transformations over the past 50 years.** In the 1980s, the rise of liberal policies and the expansion of free trade spurred rapid global economic growth, bringing emerging Asian economies such as China, India, and South Korea to prominence. In the 2000s, advances in information and communication technologies deepened global integration, and the BRICS countries emerged as major players in the global economy. While the 2008 financial crisis posed serious challenges for developed countries, the post-crisis period saw rising growth rates among developing nations. Between 2020 and 2024, the COVID-19 pandemic and rising geopolitical tensions negatively impacted global trade and slowed growth rates. Nevertheless, developing economies continued to grow at a rate of 4.2%, while growth in developed countries decelerated.

117. **Globalization and digitalization have served as major engines of economic growth.** In particular, the spread of the internet and mobile technologies has expedited and broadened the flow of trade and information. In this context, service industries and the knowledge economy have gained considerable importance. The pandemic and its aftermath saw a rapid expansion of the digital economy and e-commerce, reshaping the global economic structure. E-commerce giants such as Amazon and Alibaba have emerged as new actors in global trade. Digital technologies have revolutionized a wide range of sectors, from financial services and healthcare to education and retail. Blockchain technologies, fintech solutions, and AI applications have made economic transactions and trade more secure, efficient, and transparent. Moreover, digitalization has helped increase financial inclusion in developing countries, thereby supporting their economic growth.

Terminal İstanbul: Türkiye's Center for Entrepreneurship and Innovation

Technology-based entrepreneurship is a fundamental driving force behind economic growth and innovation ecosystems. Thanks to its strategic location and strong entrepreneurial potential, İstanbul is on its way to becoming a global center of attraction. In this regard, Terminal İstanbul Entrepreneurship Center is being established with the goal of strengthening İstanbul's entrepreneurship ecosystem and supporting technology-oriented, innovative business models. Developed by repurposing the terminal buildings of Atatürk Airport, Terminal İstanbul will become a true meeting point for students, entrepreneurs, investors, universities, and major technology companies. With its diverse set of functions, including incubators, accelerator programs, R&D laboratories, testing centers, Deneyap workshops, coding schools, a science center, a children's university, and shared working spaces, the project will offer robust support to the entrepreneurship ecosystem. Scheduled to launch its first phase in 2025, Terminal İstanbul will enhance Türkiye's global competitiveness in the fields of technology and entrepreneurship and help position İstanbul among the world's leading centers of innovation.

Logistics and Supply Chains

118. **Global supply chains have undergone major shifts due to factors such as the COVID-19 pandemic, geopolitical tensions, and trade wars.** The pandemic exposed the fragility of supply chains and caused significant disruptions in production and distribution processes. Shortages in the supply of critical products such as microchips, medical supplies, and food prompted countries to develop strategies aimed at making supply chains more resilient and flexible. Geopolitical tensions have also played a key role in reshaping global supply chains. Trade wars between the United States and China have driven many companies to relocate their production activities away from China. For instance, major technology companies like Apple have diversified their supply chains by shifting production to alternative countries such as Vietnam and India. These changes are not only relevant in terms of cost and efficiency but also crucial for achieving strategic autonomy and supply chain resilience. In addition, the energy supply challenges and rising energy prices triggered by the Russia–Ukraine war have accelerated efforts by many European countries to reduce their energy dependence. In response to the energy crisis, these countries have begun reorganizing their production processes and scaling up investments in renewable energy.

119. **Global logistics trends have also been shaped by these developments.** In particular, automation and digitalization are increasing operational efficiency in the logistics sector and facilitating supply chain management. However, the lack of a qualified workforce in the logistics industry continues to hamper supply chain performance. According to a 2022 report by the Asian Development Bank, training skilled labor in the logistics sector and increasing investments in this area should be considered a top priority for global economies. These shifts and strategies are creating both new opportunities and challenges for global supply chains. In this context, digitalization and automation are emerging as key trends in global logistics and supply chain management. The competence of companies and countries in adapting to these changes will be critical to ensuring the sustainability and competitiveness of global trade.

120. **In recent years, disruptions to global supply chains have prompted both companies and countries to reassess their sourcing strategies.** In this context, approaches such as friendshoring, reshoring, and diversification have come to the fore. The friendshoring strategy refers to the relocation of supply chains to reliable allied countries, with the aim of fostering political and economic stability while strengthening trust among trading partners. For instance, the United States and the European Union have been shifting manufacturing and supply operations away from China and toward allied nations such as India, Vietnam, and Mexico. This approach not only offers cost advantages but also enhances the resilience of supply networks. Reshoring, on the other hand, involves companies bringing manufacturing activities back to their home countries. This strategy has gained even greater importance in the aftermath of the vulnerabilities revealed by the pandemic. Diversification entails efforts to broaden supply chains by sourcing from multiple locations, thereby reducing exposure to disruption and managing risk. Rather than relying on a single supplier, companies are increasingly working with alternative vendors across different regions.

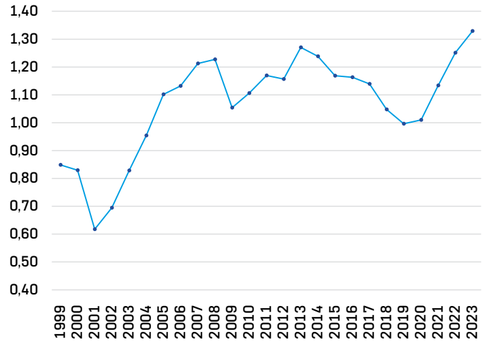


Figure 8: Türkiye's Share in Global Manufacturing Value Added (%)
Source: World Bank, World Development Indicators.

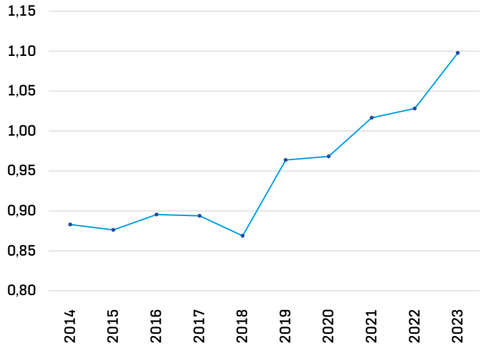


Figure 9: Türkiye's Share in Global Exports (%)
Source: ITC TradeMap

121. **Türkiye has taken significant strides in recent years to play a more active role in the global economy.** The country's strategic location, at the crossroads of continents, highlights its potential to become a critical node in global supply chains. In parallel, Türkiye's young and dynamic workforce offers high productivity and adaptability in industrial production. To leverage these advantages, Türkiye is aiming to deepen its integration into global value chains through innovative strategies and international partnerships.

122. **Drawing on its historical legacy and geopolitical responsibilities, Türkiye seeks to bolster regional economic integration by building Development and Trade Corridors linking Asia, the Middle East, and Europe.** Projects such as the Development Road, which connects the Persian Gulf port of Al-Faw to Europe, and the Zangezur-Nakhchivan-Kars corridor, forming another arm of the Trans-Caspian Middle Corridor, will establish strategic infrastructure that facilitates trade and promotes sustainable development. Under the leadership of the Ministry of Industry and Technology, and through institutions such as TÜBİTAK, KOSGEB, and TSE, Türkiye will also share its industrialization experience with restructuring countries, particularly in the Turkic States, the Middle East, and Africa. By supporting production capacity and research infrastructure in these regions, Türkiye aims to reinforce its role in regional economic cooperation and technological leadership.

Map 1: The Middle Corridor and Development Road
Source: Ministry of Transport and Infrastructure, 2025

123. **Enhancing logistics infrastructure will further strengthen Türkiye's position in global trade.** The number and efficiency of logistics hubs will be increased, and connectivity between industrial zones, ports, and rail networks will be improved. In addition, adopting multimodal transport practices on the Türkiye–Europe trade route and strengthening international railway links will significantly expand the country's logistics capacity. These efforts will contribute to increased trade volume and greater competitiveness.

Non-Tariff Barriers

124. **Non-tariff technical barriers in global trade pose major challenges to commercial relations and directly impact competitiveness by restricting market access.** In this context, the Turkish Standards Institution (TSE), Türkiye's national standards authority, plays a critical strategic role. By ensuring that Turkish products comply with international standards, TSE facilitates access to global markets. Its certification services, which cover product safety, quality standards, and technical conformity, enhance the international acceptance of Turkish goods and help mitigate technical trade barriers. Nevertheless, it remains essential to continuously strengthen the standardization and certification ecosystem in order to transform existing competitive advantages into concrete gains. Expanding national capacity in standardization, conformity assessment, certification, and testing laboratories is therefore one of Türkiye's key priorities. In line with this goal, TSE's organizational structure and service portfolio will be reinforced so it can also serve the broader region. The standardization and certification infrastructure will likewise be instrumental in enabling the twin transition. TSE will scale up its standardization and conformity assessment services in areas such as operational technologies (OT), IT systems, and connected products—thereby supporting the digital transformation of industry. Moreover, TSE will extend its services in forward-looking fields shaped by industrial transformation, such as supply chain management, traceability, the circular economy, eco-design, life cycle assessment, sustainability, and climate action. It will also be crucial to combat informal or non-compliant production and prevent practices that distort competition. Products that fail to meet standards or lack relevant product safety certification must be monitored and inspected accordingly. Internationally recognized measurements and calibrations performed by TÜBİTAK's National Metrology Institute (UME) through its reference systems also make important contributions to global trade. These systems, aligned with emerging technologies and international norms, support both national technological progress and Türkiye's integration into global markets. TÜBİTAK UME's new reference measurement systems, which are expected to gain global recognition through international comparisons, will further enhance Türkiye's competitiveness by offering metrological services and calibration capabilities to industry.

Critical Raw Materials

125. **Rapid global economic growth and technological advancements have driven increasing demand for critical minerals across various industries.** Minerals such as lithium, cobalt, nickel, and rare earth elements, which are essential in electric vehicles, renewable energy technologies, and high-tech products, are reshaping global supply and demand dynamics. Owing to geopolitical risks, environmental concerns, and sustainability objectives, the supply of these resources has become strategically vital. Managing the environmental and social impacts of mineral exploration, extraction, and processing is of particular importance. In addition, recycling and reusing these minerals presents significant potential for optimizing resource use.

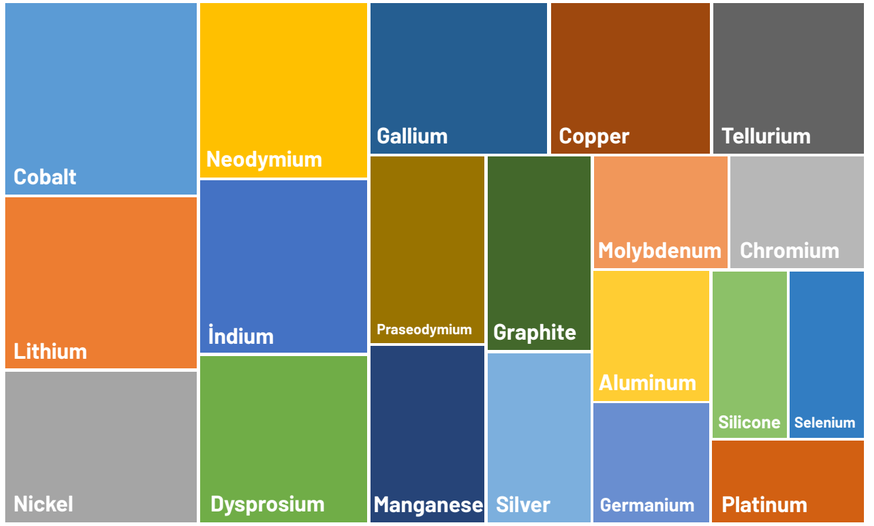


Figure 10: Top 20 Critical Minerals and Raw Materials by Number of National Lists Included (2023)
Source: UNCTAD, Digital Economy Report 2024.

126. **Many countries are adopting new strategies to secure supplies of critical minerals.** Major economies such as the United States and China are stepping up domestic production and building strategic reserves in an effort to guarantee the supply chains of critical minerals. The U.S. Department of Energy has introduced incentive schemes and research programs to support domestic production and the development of recycling technologies. China, meanwhile, is expanding its production capacity, increasing global investments, and imposing export restrictions to maintain its dominance in the rare earth market. The European Union has also stepped up its efforts with the introduction of the Critical Raw Materials Act in 2020, taking solid steps to build strategic partnerships. In Türkiye, the Strategic and Critical Minerals Report has laid the groundwork for actions aimed at reducing external dependency and establishing sustainable supply chains. In this regard, the effective use of domestic resources and the advancement of recycling technologies will be key to fulfilling Türkiye's industrial and technological policy goals.

Industrial and Technology Diplomacy

127. **Industrial and technology diplomacy has become an essential lever for enhancing countries' global competitiveness.** For Türkiye, this domain is critical to fostering economic development and strengthening international relations. Advances in industry and technology not only increase production capacity but also create strategic opportunities in areas such as market access, innovation, and technology transfer. Consolidating Türkiye's industrial and technological engagement with the world contributes to its competitiveness, supports domestic production, and facilitates the international recognition of indigenous technologies. Türkiye's approach to industrial and technology diplomacy is especially important in its efforts to adapt to the Fourth Industrial Revolution and the twin transition. By forging partnerships in digital transition, artificial intelligence, mobility, space, semiconductors, advanced manufacturing, and sustainable energy technologies, Türkiye aspires to assume a leadership role in these critical areas. Such initiatives will not only position Türkiye as a manufacturing hub but also enable it to become a developer and exporter of high-tech solutions, thereby enhancing its standing in international affairs. Technological cooperation deepens diplomatic ties and fosters mutual interdependence, which in turn facilitates the resolution of international conflicts.

Antarctic Polar Research Station

Under the auspices of the Turkish Presidency, polar research efforts launched in 2017 have served as a pioneering initiative for advancing scientific research, raising national awareness of polar regions, and enhancing Türkiye's international standing. As part of the endeavor to establish an Antarctic Polar Research Station, Türkiye submitted the draft design and Environmental Impact Assessment (EIA) report to the Antarctic Treaty Consultative Meeting and the Committee for Environmental Protection.

The process was completed with positive feedback. Designed with a modular structure for rapid construction, the station will consist of three main units and have the capacity to accommodate up to 50 personnel. It will operate primarily using renewable energy sources. Türkiye's tenth Antarctic expedition is scheduled for the 2025–2026 season. To coordinate and guide research in polar studies, develop national strategies, and ensure interagency collaboration, a Polar Regions Coordination Board will be established under the leadership of the Ministry of Industry and Technology.

European Union Critical Raw Materials Act (CRMA)

The CRMA is designed to safeguard critical raw material supply chains and ensure strategic autonomy. It is designed to reduce the EU's dependency in industrial and technological sectors by ensuring more sustainable and diversified access to critical raw materials.

Accordingly, the Act stipulates that at least 10% of critical raw materials must be extracted within the EU, 40% must be processed within the Union, and 25% must be sourced through recycling. It also mandates that member states streamline the permitting processes for domestic extraction projects and designate such projects as strategic. In addition, member states are required to develop national exploration plans to support diversified sourcing.

To further reduce dependency, the European Commission is launching initiatives to diversify sources of raw material imports. The Act requires large companies to conduct a critical raw material supply chain risk assessment every three years. It also includes provisions for labeling products containing critical raw materials and increasing their recycling rates. Furthermore, CRMA imposes obligations on companies operating within the EU to collect and report data and ensure full traceability of critical raw materials from extraction to processing.

The European Commission also plans to establish a joint purchasing mechanism to be used by raw material consumers in the EU. Through this mechanism, critical raw material buyers within the EU will consolidate their demand and collectively issue procurement calls to suppliers. List of Critical Raw Materials: Antimony, Copper, Lithium, Scandium, Arsenic, Feldspar, Magnesium, Silicon metal, Aluminum/Bauxite, Fluorspar, Manganese, Strontium, Barite, Gallium, Natural Graphite, Tantalum, Beryllium, Germanium, Battery-grade Nickel, Titanium metal, Bismuth, Hafnium, Niobium, Tungsten, Boron/Borates, Helium, Phosphate rock, Vanadium, Cobalt, Heavy Rare Earth Elements, Phosphorus, Coking Coal, Light Rare Earth Elements, Platinum Group Metals. List of Strategic Raw Materials: Bismuth, Gallium, Battery-grade Manganese, Rare Earth Elements for magnets (Nd, Pr, Tb, Dy, Gd, Sm, Ce), Metallurgical-grade Boron, Germanium, Battery-grade Natural Graphite, Silicon metal, Cobalt, Battery-grade Lithium, Battery-grade Nickel, Titanium metal, Copper, Metallic Magnesium, Platinum Group Metals, Tungsten.

Source: https://rmis.jrc.ec.europa.eu/eu-critical-raw-materials

128. **A number of organizations and agencies in Türkiye—chiefly the Ministry of Industry and Technology—are actively engaged in industrial and technology diplomacy.** In this context, KOSGEB, TSE, TÜBA, TUA, and TURKPATENT are undertaking significant initiatives to strengthen international partnerships within their respective fields of expertise, both through bilateral cooperation and participation in international organizations. TÜBİTAK, which plays a central role in supporting and conducting scientific research in Türkiye, collaborates with peer institutions in numerous countries through joint project calls and provides support to academic and industrial actors. It also advances international R&D efforts

and strategic partnerships via its thematic institutes and R&D facilitation units. "Joint Industry and Technology Working Group Meetings," coordinated by the Ministry of Industry and Technology, provide a key platform for exploring cooperation opportunities with other countries in the areas of industry, technology, and investment. Moreover, the Ministry takes part in and contributes to the international programs and projects conducted by global and regional organizations such as the United Nations and OECD, particularly in the fields of industry and technology. It also works to ensure that businesses, local governments, academia, and other stakeholders in Türkiye benefit effectively from the European Union's Framework Programs for R&D and Innovation as well as the Instrument for Pre-accession Assistance (IPA). By expanding its international footprint and enhancing its global engagement, the Ministry aims to carry out industrial and technology diplomacy more effectively, while fostering strategic partnerships with priority countries and regions.

Spaceport and Independent Access to Space

As part of the National Space Program, the goal of establishing a spaceport and achieving independent access to space aims to enable Türkiye to conduct autonomous space launches. This initiative will involve deploying domestically developed and nationally owned space vehicles into orbit and establishing a sustainable, competitive industrial ecosystem for launch technologies. As part of the program, indigenous launch vehicles will be developed, and research, development, and testing activities will be carried out to achieve national capabilities in critical space technologies. Efforts will also be made to develop domestic infrastructure, subsystems, and equipment related to space technologies and to address existing gaps in these areas. There is an ongoing endeavor to establish national and international partnerships in pursuit of this objective. The spaceport will also be made commercially available, offering services to the private sector and creating economic value. The launch vehicles will be tested through trial launches on suitable platforms. In the initial phase, national satellites will be launched into orbits such as Low Earth Orbit (LEO) and Geostationary Orbit (GEO), with the broader objective of meeting satellite launch demands on the international market.

Goal 4. Promoting integration into global markets and boosting competitiveness

Strategies

Strategy 58	To bolster Türkiye's resilience to disruptions in global value chains, new measures will be introduced, and mechanisms to diversify both exports and imports will be established.
Strategy 59	Innovative strategies and sector-specific financing models will be developed to support deeper integration into global value chains, particularly in key export sectors such as motor vehicles, machinery, and electrical equipment. Partnerships between international investors and domestic suppliers will be encouraged to help local firms become more embedded in global value chains.
Strategy 60	Joint defense industry investments with European countries will be strongly supported to give momentum to the development and market entry of innovative products and technologies.
Strategy 61	Country-specific trade strategies will be formulated, and regional cooperation agreements will be expanded to reinforce Türkiye's role as a regional trade and production hub across the Middle East, North Africa, Europe, and Central Asia.
Strategy 62	Sector-oriented R&D and investment incentives, along with market development programs, will be implemented to boost exports in strategic fields such as artificial intelligence, cybersecurity, renewable energy technologies, and biotechnology.

Strategy 63	Potential raw material deposits will be identified through satellite imaging, 3D subsurface mapping, and geophysical methods to secure access to critical minerals. The development of recycling capabilities and advanced processing technologies will also be promoted.
Strategy 64	International alliances and strategic partnerships will be established to safeguard the supply and processing of critical raw materials, thereby enhancing resilience against global supply chain disruptions.
Strategy 65	Integrated petrochemical clusters will be developed to increase value-added petrochemical production and to strengthen Türkiye's presence in the global energy market. Processing capacities will be expanded, and innovation in advanced polymers and chemical derivatives will be encouraged through R&D support.
Strategy 66	Digital customs systems, e-commerce platforms, and blockchain-based logistics solutions will be developed to improve efficiency in export operations, ensuring access to these infrastructures for SMEs.
Strategy 67	Logistics infrastructure will be modernized and more closely integrated with industrial zones. Intermodal and combined transport systems will be expanded to improve efficiency and competitiveness in international trade.

Strategies

Strategy 68	Under the Decree on Supporting Overseas Logistics Distribution Networks, logistics hubs will be established to help exporters integrate more swiftly and effectively into international supply and distribution chains.
Strategy 69	Policies will be introduced to support compliance with international standards, thereby enhancing the global market integration and competitiveness of businesses, particularly SMEs.
Strategy 70	Strategic branding and international marketing efforts will be supported to increase the global visibility of local products.
Strategy 71	Targeted promotional campaigns will be conducted to attract foreign investment in key sectors such as semiconductors, electric vehicles, data centers, and petrochemicals. Incentive mechanisms will be designed to be selective and goal-oriented.
Strategy 72	The effective management and strategic use of intellectual property rights will be ensured to support technological advancement and drive twin transition.
Strategy 73	Drawing on Türkiye's historical legacy and geopolitical role, Development and Trade Corridors will be established linking Asia, the Middle East, and Europe, with focal points in Al-Faw (Basra) and Zangezur (Caspian region).

Strategy 74	Led by the Ministry of Industry and Technology and affiliated/relevant institutions such as TÜBİTAK, KOSGEB, and TSE, Türkiye will undertake a leadership role in sharing its industrial development experience—particularly with re-structuring countries in the Turkic States, the Middle East, and Africa—to support the growth of their production and research ecosystems.
Strategy 75	The TEKNOFEST Aerospace, Space and Technology Festival will be expanded to the Turkic States, the Middle East, Africa, the Balkans, and the Black Sea region.
Strategy 76	The Ministry of Industry and Technology will restructure global partnership mechanisms and implement the Science, Technology, Innovation, Industry, and Investment (STI^3) Diplomacy framework.
Strategy 77	Türkiye's research infrastructures will be aligned with EU institutions, programs, and cooperation platforms.
Strategy 78	Training and awareness programs will be launched to improve the adaptability of business owners and employees to the global business environment, covering topics such as international trade, standardization, digital marketing, foreign languages, and intercultural communication.

GOAL 5

Addressing Productivity, Capacity, and Scale-Related Challenges in the Manufacturing Industry, and Enhancing Resilience to Crises and External Shocks

PLANNED AND SUSTAINABLE DEVELOPMENT OF INDUSTRY

NEW INVESTMENT INCENTIVE SYSTEM

PUBLIC PROCUREMENT AND INVESTMENTS

SECTORAL COMPOSITION

PRODUCTIVITY, SCALING UP, AND COMPETITIVENESS

REGIONAL DEVELOPMENT

RESILIENCE TO NATURAL DISASTERS

DATA-DRIVEN DECISION-MAKING PROCESSES

INCLUSIVE EMPLOYMENT AND SKILLS MATCHING IN INDUSTRY

STRATEGIES

GOAL 5

Addressing productivity, capacity, and scale-related challenges in the manufacturing industry, and enhancing resilience to crises and external shocks

Planned and Sustainable Development of Industry

129. **Since its founding, the Republic of Türkiye has made remarkable strides in industrial development over the course of more than a century, evolving into a major production hub in both its region and the world.** In the early years of the Republic, active industrial policies were implemented in line with national growth and industrialization goals, with a particular focus on producing basic consumer goods and industrial inputs domestically. Within the framework of import-substitution industrialization, a labor-intensive industrial base was established, prioritizing the use of domestic inputs and centered around mining and agriculture-based industries to meet essential national needs. Despite the adverse effects of events such as the Great Depression of 1929 and the Second World War, these policies remained largely in place until the late 1970s. After 1980, Türkiye shifted toward export-oriented industrial strategies, aligning its policies with global trends in liberalization and globalization. This period saw a focus on liberalizing capital markets, reducing trade barriers, adopting a flexible exchange rate regime, supporting exporters, and promoting foreign direct investment. Türkiye's accession to the World Trade Organization in 1995 further advanced its integration into global trade, while the Customs Union established with the European Union played a pivotal role in removing trade barriers and encouraging economic integration. Although investments in transport and communication infrastructure during this period indirectly supported industrial development, the broader shift in focus toward non-industrial sectors led to a noticeable decline in the industrial sector's contribution to the economy. The manufacturing sector was severely affected by the global financial crisis of 1997–1998, the 1999 earthquake, and the economic crisis of 2001. In terms of value-added production, Türkiye's industrial sector, for the most part, failed to progress beyond assembly-based manufacturing until the 2000s. The country was unable to establish a robust R&D ecosystem and thus missed the opportunity to lead in development through technological capability.

130. **However, following the 2001 crisis, the restoration of political stability, the strengthening of the financial system, and the enhancement of economic resilience enabled Türkiye to recover more swiftly from subsequent shocks.** The 2008 global financial crisis marked a turning point in industrial policy worldwide. As many governments renewed their focus on industrial policy, Türkiye followed suit. The 2011–2014 Turkish Industrial Strategy Document signaled this renewed focus, setting the objective of transforming Türkiye into "the production base of Eurasia." The 10th Development Plan (2014–2018) identified key priorities such as improving productivity in production and reducing dependency on imports.

These plans underscored the importance of increasing productivity in the industrial sector, promoting production that enhances domestic value-added, and intensifying R&D, innovation, and design efforts in medium-high and high-tech product segments. The 11th and 12th Development Plans designated a series of priority sectors including chemicals, pharmaceuticals and medical devices, electronics, machinery, electrical equipment, automotive, and rail systems. In the 2023 Industry and Technology Strategy Document, the emphasis on domestically developed and nationally owned production emerged as a central focus and has since been backed by concrete forward-looking actions.

131. **Since the early 21st century, Türkiye has made significant progress in industry and technology, taking bold steps toward production-driven development.** During this period, a comprehensive ecosystem for R&D, innovation, and entrepreneurship was established. The country's capacity for high value-added production has been significantly enhanced, and considerable progress has been made toward the goal of becoming a nation that develops its own technologies. Türkiye has been transformed into a major manufacturing base through an attractive incentive system that motivates investment in industry, thereby strengthening its global integration and export potential. Despite these successes, certain structural issues still present opportunities for further development in the industrial sector.

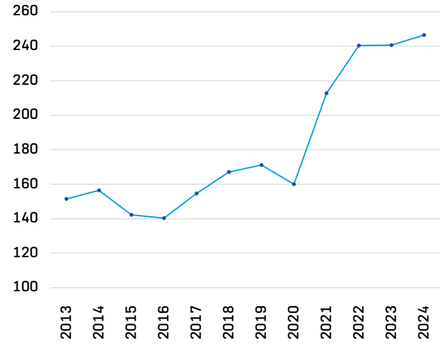


Figure 11: Manufacturing Industry Exports of Türkiye (billion USD)
Source: TurkStat, Foreign Trade Statistics

132. **The strategic autonomy and technological independence underscored by the National Technology Initiative rest on one fundamental condition: a Türkiye that produces.** As a prominent global economy, Türkiye has demonstrated steady long-term growth despite experiencing short-term disruptions during global crises. Although the share of manufactur-

ing in GDP declined between 1998 and 2010, this trend has since reversed, reaching 19.4 percent in 2023. Industrial employment rose from 22 percent in 1998 to approximately 27 percent in 2006 and has remained relatively stable since. Labor productivity in the manufacturing sector, particularly in the post-COVID-19 period, has increased at a rate above the average, making a significant contribution to the overall rise in labor productivity.

133. **Türkiye has mitigated the risk of deindustrialization through active industrial policies focused on domestically developed and nationally owned production.** Active policies that foster green and digital transition, while strengthening global integration and resilience, have enabled the industrial sector to preserve and expand its share in the economy. In this context, the strategy adopted in Türkiye's industrial policy not only sustains economic growth but also supports the realization of strategic autonomy and technological independence. Türkiye remains firmly committed to advancing its industrialization policies to enhance global competitiveness and achieve sustainable economic growth.

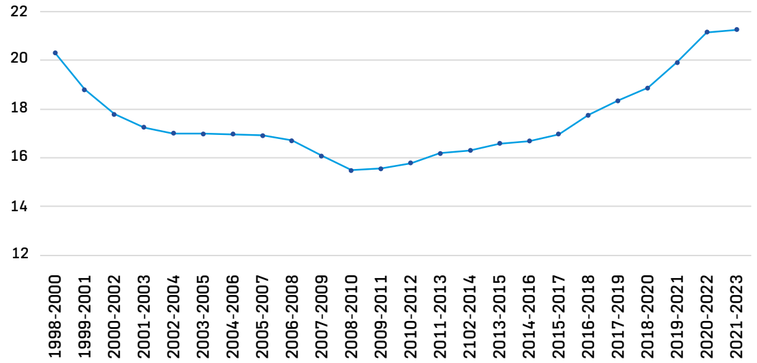


Figure 12: Share of Manufacturing Industry Value Added in GDP (% – 3-Year Moving Average)
Source: World Bank, World Development Indicators.

134. **In parallel with paradigm shifts in the global economy, the role of the state in the market is being redefined.** States are no longer limited to a regulatory role; they now also act as active entrepreneurs, investors, and innovation enablers in strategic sectors. China's rapid progress in artificial intelligence and renewable energy is an outcome of the state's strong capacity for strategic planning and implementation. This transformation requires agile decision-making and effective coordination. The EU's strategic autonomy policies include significant public measures in the areas of technological advancement and supply chain resilience. The cooperation between governments and the private sector, policy

frameworks focused on technology and innovation, and goals for sustainable development are becoming foundational elements of the new economic order. The ability to make quick decisions, coordinate effectively, and foster innovation will be critical to success under this emerging paradigm. In this regard, Türkiye will enhance its global competitiveness and national security by formulating and rapidly implementing targeted strategies in critical technology fields.

135. **The shift toward high technology in Turkish industry has not yet occurred at the desired scale.** Nevertheless, there is strong potential to accelerate this process through a skilled workforce, targeted incentive policies, and the growing culture of entrepreneurship and R&D. In the coming period, planned industrial areas will be expanded, and the physical, technical, and financial infrastructure of Organized Industrial Zones (OIZs) will be strengthened. In particular, expediting the green and digital transitions is of critical importance for enhancing the global competitiveness of industry.

Mega Industrial Parks

Integrated, fully serviced mega industrial parks will be developed for strategically significant national and regional investments, with plans incorporating both infrastructure and the surrounding social environment. As part of the National Master Plan for Industrial Areas, 32 distinct areas across 16 provinces along the Samsun-Mersin corridor—totaling 166,000 hectares—have been identified as potential industrial sites. The Mega Industrial Parks Project envisions the establishment of fully integrated industrial cities. These multi-functional, integrated industrial cities will feature logistics infrastructure with access to ports, railways, and airports; foster industrial symbiosis; support green transition through their ecological and environmental planning; and house technology hubs—such as data centers, incubation centers, R&D facilities, technology development zones, and innovation centers—with business centers, residential areas, and education and social service facilities.

136. **Expanding industrial areas is vital for attracting both domestic and international investors.** Country examples from the second half of the 20th century, particularly Germany and Italy, demonstrate that planned industrial areas strengthen national industrial infrastructure and enhance global competitiveness. Türkiye, through a similar approach, can create new opportunities for entrepreneurs and attract foreign investment by expanding its industrial base. The National Master Plan for Industrial Areas, currently under development, adopts a comprehensive approach that integrates strategic,

economic, environmental, and social dimensions. A governance and coordination mechanism involving all stakeholders in the industrial sector has been established to implement the Plan. This mechanism aims to facilitate collaboration toward shared objectives by bringing together public institutions, industrial enterprises, local authorities, civil society organizations, academic institutions, and other relevant stakeholders.

137. **Substantive legislative reforms have been introduced to the legal framework governing OIZs, establishing a transparent, rules-based governance model.** Under these new regulations, available land in all OIZs is now listed monthly on an online platform for investor applications. In newly established OIZs, a pre-allocation model has been adopted, under the same rules, to secure the resources needed for rapid expropriation and infrastructure development. OIZs, which have served as the backbone of Türkiye's industrialization and production since the 1960s, will have their energy, transport, and communication infrastructure modernized in the coming period to enable more efficient and sustainable production processes. Intermodal transport solutions will also be implemented to integrate rail, road, and maritime networks; connections between industrial zones and ports, logistics centers, and international trade corridors will be strengthened. Moreover, alternative financing mechanisms will be developed to support the infrastructure investments of OIZs.

New Investment Incentive System

138. **The incentive system, one of the main instruments of Türkiye's industrial policy, is employed to guide and accelerate investments.** Designed to enhance competitiveness in strategic sectors and reduce regional disparities in development, the investment incentive system features a structure that supports these dual goals. Comprehensive support mechanisms, ranging from employment-focused subsidies to tax reductions, customs duty exemptions, and credit financing support, alleviate investors' financial burdens, making it possible for investment plans to be implemented and sustained. Although the existing incentive system is broad and inclusive, a revision is currently underway to streamline procedures, uncover local dynamics and potentials of provinces, and introduce a more selective approach to value-added and technology-intensive sectors. Another necessity is the development of support instruments aligned with current economic conditions.

Ceyhan Petrochemical Industrial Zone

In the field of petrochemicals, which is one of Türkiye's largest import categories, a nationwide investment initiative will be launched, addressing the full spectrum of identified needs and priorities, from upstream elements of the value chain to high value-added final products. Given the necessity for petrochemical investments to be large-scale and integrated, and considering the importance of logistics capabilities, a petrochemical cluster will be developed to accommodate major investments. To tap into the sector's high investment potential, a new Petrochemical Industrial Zone covering approximately 30 million square meters and featuring its own port is planned to be established in Ceyhan. Efforts will focus on attracting foreign investments, positioning the region as a major global petrochemical hub. With the establishment of the Ceyhan Petrochemical Industrial Zone, Türkiye will take significant steps to increase domestic production capacity in petrochemicals and reduce foreign dependency in the supply chain. These investments will not only promote the production of value-added goods but will also expand national production capacity and enhance the competitiveness of both the sector and related industries.

139. **The redesigned incentive system aims to make the current model more efficient and target-oriented, increase selectivity, and optimize the scope of support.** Furthermore, the new model will be structured to ensure greater alignment with national plans, enhance its effectiveness in terms of employment generation and access to finance, and address interregional disparities through restructured implementation mechanisms. Integrating green and digital transition priorities into incentive policies will also be among the key objectives of the new system.

140. **The new investment incentive system will be structured around two core components: the "Century of Türkiye Development Initiative" and the "Sectoral Incentive System."** Under the "Century of Türkiye Development Initiative," three programs—"Technology-Focused Industrial Move," "Local Development Move," and "Strategic Initiative"—will be implemented using a project-based approach. The Sectoral Incentive System will consist of the "Priority Investments" and "Targeted Investments" programs, to be carried out based on general rules. The new incentive model aims to support projects of strategic importance that align with the targets set out in the Development Plans, enhance Türkiye's capa-

bilities in critical technologies, ensure supply security, reduce external dependency, and boost global competitiveness. Projects that help reduce regional disparities by taking into account provinces' unique characteristics, resources, and internal dynamics will also be prioritized. Moreover, the new incentive system will strongly support twin transition investments aligned with Türkiye's green and digital transition goals.

Employment Protection Program in Labor-Intensive Sectors

Global economic fluctuations and sectoral uncertainties can negatively impact the employment levels and sustainability of labor-intensive small and medium-sized enterprises (SMEs). From the perspective of securing economic growth and ensuring development stability, it is crucial to ease SMEs' financial burdens and safeguard their fiscal balance.

To help protect employment in labor-intensive manufacturing sectors such as textiles, furniture, leather, and apparel, KOSGEB has launched the Employment Protection Support Program. This program contributes to job retention, operational continuity, reduced financial strain for enterprises, and sustained economic activity. Expanding this program as well as others of similar nature through broader and more inclusive incentives is essential for ensuring the long-term viability of labor-intensive sectors.

Public Procurement and Investments

141. **Public procurement, which holds a significant share in national GDPs, is becoming increasingly critical both globally and in Türkiye.** It stands out as an effective tool to support R&D and innovation activities in strategic sectors and to encourage domestic production. Global examples show that public procurement has been actively used to stimulate innovation and domestic production in critical sectors such as defense, health, energy, and transportation. Groundbreaking technologies like the internet and GPS were developed with strong public policy and procurement support. Similarly, countries have leveraged public procurement to achieve global competitiveness in critical areas such as semiconductors, vaccines, 5G, and defense technologies.

142. **In Türkiye as well, policies to foster domestic industry through public procurement have been implemented.** Under the provisions of the Public Procurement Law titled "Regulations on Domestic Bidders," price advantages are granted in favor of domestic bidders and those offering domestically produced goods. Moreover, under Industry Cooperation Projects, procurement processes conducted by public institutions adopt a technology-oriented project management approach that supports R&D and localization, rather than conventional purchasing. Despite the regulations prioritizing domestic goods and localization in public procurement, the impact in practice remains limited. The defense industry, where strategic investments were launched through public procurement and domestic content rate increased from 20% to 80%, serves as a model of best practice in this regard.

143. **The Industrialization Executive Committee (SAİK), established by a Presidential Decree, has been entitled with the authority to leverage public procurement for industrialization, domestic production, and the National Technology Initiative.** SAİK aims to extend the medium- and long-term planning approach and strong coordination, which are key success factors in the defense sector's domestic production, to other strategic industries. Operationalizing the SAİK mechanism as swiftly as possible, and supporting domestic and nationally owned industries through a common budget or dedicated fund is of critical importance. In this context, SAİK will, in the coming period, issue decisions and steer implementation for domestic production of the technologies, products, and critical components identified as priorities in the Development Plans—covering sectors such as pharmaceuticals and medical devices, rail systems, and cybersecurity.

144. **The Communiqué on Domestic Goods is one of the most significant regulations promoting and prioritizing domestic products in public procurement.** Having been in effect for a long time, the Communiqué has now been updated to reflect evolving priorities, needs, and practical challenges. Accordingly, the principles and procedures governing its implementation, including the criteria for a product to qualify as domestic, the calculation of domestic content ratios, the financial and technical review processes, and the audit mechanism, have been revised, and the Communiqué on Domestic Goods has been re-issued. The revised Communiqué introduces stricter rules for domestic content in supply chains, defines the concept of "critical components being indigenous," and updates certification and inspection procedures to promote domestic production. Under the new Communiqué, the domestic goods certificate will become a more effective tool in public procurement, triggering increased demand for domestic products. The Ministry of Industry and Technology will closely monitor the field impact and implementation of the Communiqué in collaboration with the Public Procurement Authority and other stakeholders.

Sectoral Composition

145. **Türkiye's manufacturing industry is gaining an increasingly prominent position in the global economy, supported by broad sectoral diversity.** Alongside well-established sectors such as white goods, textiles, and ready-to-wear clothing,

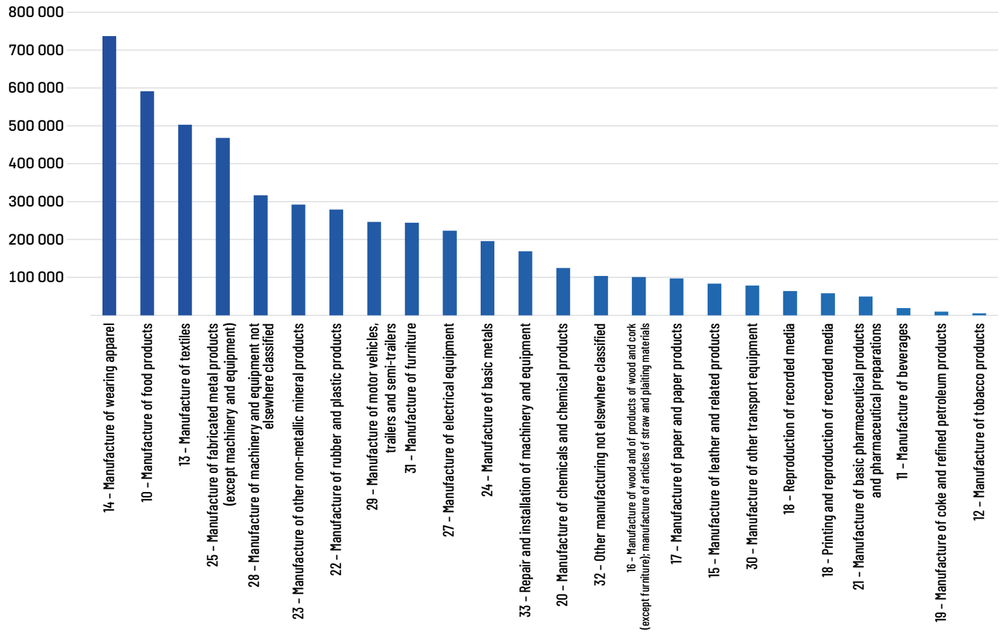


Figure 13: Number of Employees by Manufacturing Sub-Sectors (2023)
Source: TurkStat

emerging fields such as automotive, machinery, chemicals, and pharmaceuticals are among the main drivers of Türkiye's economic growth. For instance, the white goods sector is a European leader, exporting 75% of its production and pioneering energy efficiency through smart technologies. Similarly, the automotive sector achieved USD 37 billion in exports in 2024 and is accelerating its transformation through electric vehicle production. The textile and ready-to-wear industries are distinguished by their flexible production structures and logistical proximity to the EU market, enabling them to respond swiftly to fast fashion trends. Meanwhile, traditional sectors such as food and beverage manufacturing are making strong contributions to employment and foreign exchange earnings through increasing export performance. This diversity allows Türkiye to gain a competitive edge not only in production but also across various stages of the value chain.

146. **R&D, innovation, and digitalization processes represent the most promising opportunities for the future of manufacturing.** In the white goods sector, smart home appliances developed through energy efficiency innovations and IoT integration have made the industry a global leader. In textiles and ready-to-wear, sustainability-focused innovations and circular economy practices are facilitating alignment with the EU's green transition policies. In the chemicals industry, advancements in cutting-edge fields such as nanotechnology and biochemistry are expanding product diversity while making production processes more environmentally friendly. Likewise, digitalization in the machinery and automotive sectors, supported by smart manufacturing systems and investments in electric vehicles, is bolstering competitiveness. In the furniture industry, design-focused innovations aim to increase value-added output, while global trends such as organic and healthy products in the food and beverage sector are creating new export and growth opportunities.

147. **The structural issues faced by the manufacturing industry necessitate more integrated growth across sectors.** Although the production capacity of the white goods and automotive sectors in Türkiye is quite strong, there is still considerable progress to be made in developing original brands and achieving global recognition. In the textile and ready-to-wear clothing sector, structural issues such as high energy costs and informal employment hinder sustainable growth, while raw material dependency in the chemical and petrochemical sectors limits the benefits derived from sectoral economies of scale. Although the food and beverage manufacturing and furniture sectors have secured a notable position in global markets with high-quality products, logistics costs and shortcomings in marketing strategies constrain broader international outreach.

Assurance for Strategic Investments

To attract greater interest from international investors in large-scale qualified investments in priority areas, project-based risk mitigation mechanisms will be implemented to minimize the potential adverse effects of regulatory changes on the sustainability of investments, and legal assurances will be provided to investors. In order to make Türkiye a hub for investments in critical areas, regulations that will attract low-risk-tolerant international investors and enhance their resilience against investment-related risks will be enforced. For large-scale investments, Project-Based Incentive Decisions will include support mechanisms to limit the impact of regulatory changes that may adversely affect investment feasibility.

148. **The future of the manufacturing industry will be shaped by the collective development of sectors along the axes of sustainability and digitalization.** For instance, energy-efficient products and smart technologies in the white goods sector offer more tangible and applicable opportunities for integration with other sectors. Moreover, the smart sensor and IoT technologies being developed within this sector may generate significant benefits in many other industries, particularly automotive and furniture. Green transition and recycling projects in the chemical sector will also enable the use of more environmentally friendly raw materials in automotive and machinery production. Sustaining local supply chains in food and beverage manufacturing will contribute both to meeting domestic demand and to export targets. With design-oriented production, the furniture sector may achieve a more competitive position in international markets. Developing all these sectors with both integrated and, where necessary, sector-specific approaches will strengthen Türkiye's position in global value chains and enable the country to realize its sustainable development goals through the manufacturing industry.

Productivity, Scaling Up and Competitiveness

149. **Addressing productivity challenges in industry and ensuring stable, long-term improvements in productivity are key to advancing Türkiye's development.** Foremost among these challenges are the limited capacity for developing and utilizing technology, as well as the inadequate quality of the workforce. The widespread use of traditional production methods increases operational costs for businesses and undermines their competitiveness. Furthermore, the predominance of SMEs among industrial enterprises, coupled with their limited growth motivation, prevents them from fully benefiting from economies of scale. To overcome these challenges, productivity policies will be addressed through a holistic approach, enabling the structural transformation of Turkish industry, with a focus on productivity. In this context, efforts to raise the productivity levels of both labor and capital will be complemented by the promotion of lean production practices and the integration of green and digital transition processes—each of which will constitute a core element of productivity policy.

150. **Total factor productivity (TFP) holds critical importance for both the Turkish economy and its industrial sector.** As a key indicator of the efficient use of production inputs and a reflection of an economy's capacity to adapt to technology, TFP serves as a fundamental driver of development and prosperity. Compared with advanced economies, Türkiye possesses considerable potential for productivity growth. Accordingly, a commitment will be made to raising productivity in a planned and sustained manner through the formulation of medium- and long-term strategies. In this regard, it is essential to establish a robust data infrastructure to systematically monitor and report productivity indicators—particularly TFP and labor productivity.

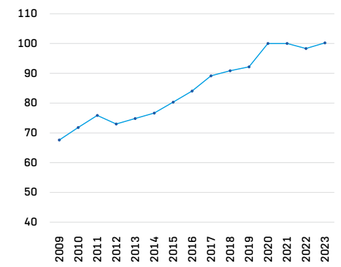


Figure 14: Manufacturing Industry Production Index per Hour Worked (2021=100)
Source: EIS, Quarterly Productivity Statistics.

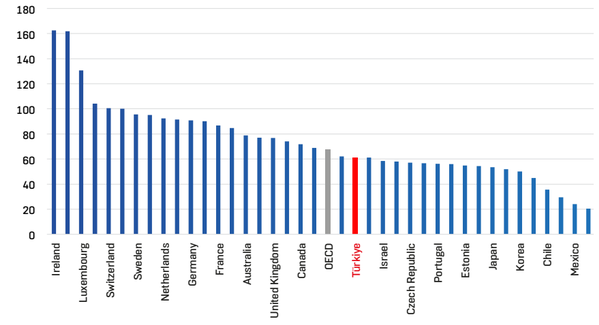


Figure 15: Value Added per Hour Worked (2022)
Source: OECD, Compendium of Productivity Indicators 2024

151. **The "Competence and Digital Transformation Center (Model Factory)" Project, implemented under the coordination of the Ministry of Industry and Technology, is one of the core policy instruments designed to boost productivity in industry.** Conducted in partnership with chambers of industry and commerce, universities, and organized industrial zones (OIZs), the primary goal of Model Factories is to guide businesses—particularly SMEs—toward productivity gains by delivering services to as many enterprises as possible. The Model Factory approach is based on experiential learning principles, setting it apart from traditional capacity-building programs and consultancy services that rely solely on classroom-based training. By combining theoretical and practical training within an experiential learning framework, Model Factory programs achieve significantly higher retention rates compared to conventional approaches. Currently, Türkiye hosts ten operational Model Factories—eight in Ankara, Bursa, Konya, Kayseri, Gaziantep, Mersin, Adana, and İzmir, and two recently launched in Eskişehir and Samsun. The number of factories will continue to grow with the establishment of new ones in different provinces. Adopting a holistic approach, efforts will be made in the coming period to enhance the capabilities of Model Factories in lean production, green transition, and digital transformation. Their institutional capacities will be strengthened, and their roles as productivity interfaces will be further expanded.

152. **One of the key structural issues affecting competitiveness in manufacturing is the sector's limited ability to benefit from economies of scale.** This problem is especially pronounced among SMEs, which often face financial and technical infrastructure challenges when attempting to scale up production. Small enterprises struggle to remain resilient in dynamic markets and are often unable to compete effectively in high-productivity sectors. To address scale-related challenges in the manufacturing sector, efforts will focus on expanding access to finance for SMEs, providing scale-up incentives for priority sectors, and supporting technology transfer. In addition, the establishment of shared production and logistics infrastructures within OIZs will help reduce fixed costs for businesses.

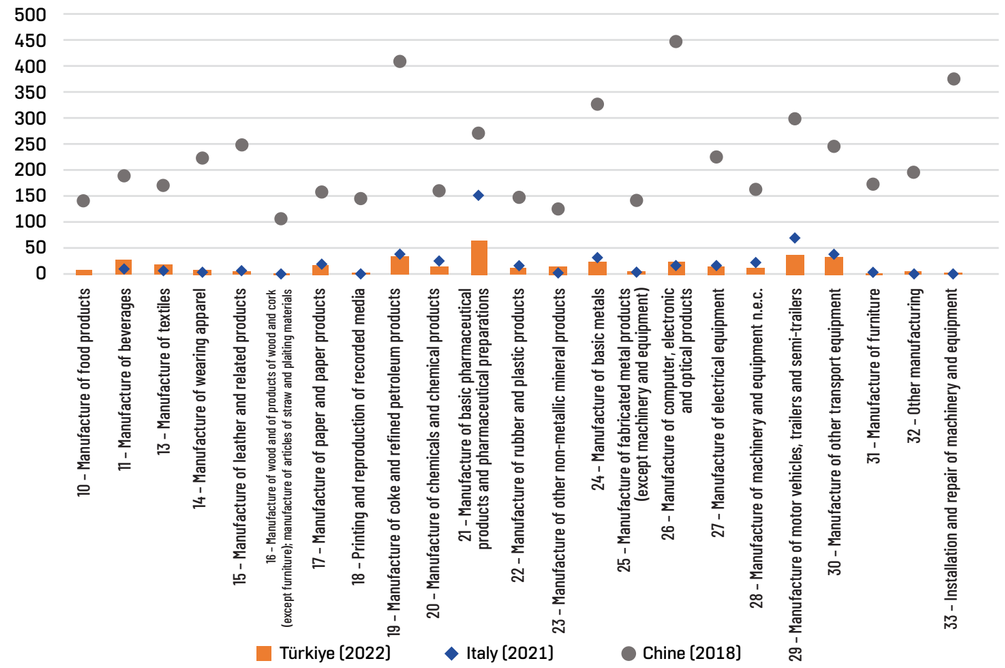


Figure 16: Average Firm Size by Sector (Comparative Data for China, Italy, and Türkiye)
Source: UNIDO, INDSTAT Revision 4

153. **Strengthening the institutional capacity of SMEs is a strategic imperative for enabling sustainable growth and ensuring the intergenerational continuity of production traditions.** Limited institutional capacity weakens operational autonomy and prevents SMEs from reaching a larger scale. By systematizing management processes, institutionalization enhances firms' resilience in crisis and risk management, allowing for more effective handling of financial, operational, and strategic risks. At the same time, aligning business processes with standards improves productivity and optimizes resource use. Institutionalization also boosts competitiveness in both domestic and international markets by fostering an environment conducive to innovation and enabling faster strategic decision-making. Moreover, it facilitates access to finance and enhances the attractiveness of firms in the eyes of investors and financial institutions. From a workforce

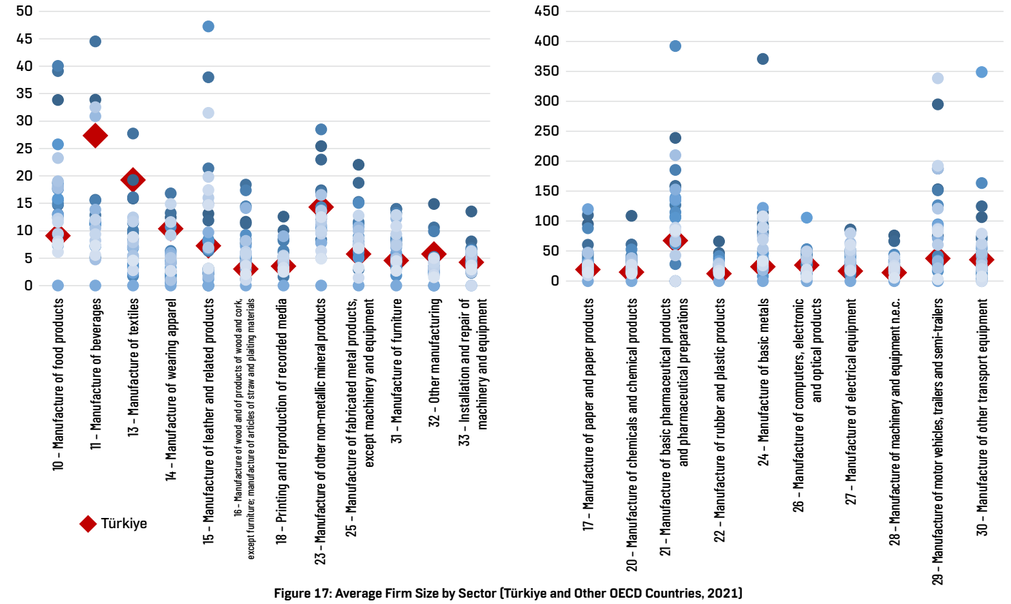


Figure 17: Average Firm Size by Sector (Türkiye and Other OECD Countries, 2021)

perspective, the stability and development opportunities provided by institutional structures help increase employee engagement and provide an advantage in attracting qualified talent. In the coming period, both financial support and technical guidance services will be leveraged to help raise the institutional maturity of SMEs, enabling them to generate greater added value for the national economy.

154. **In addition to enabling SMEs to scale up, it is equally critical to support the further growth and global competitiveness of large, industry-leading companies.** Growth in large enterprises not only strengthens their competitive edge but also paves the way for smaller firms to become more firmly integrated into the industrial ecosystem. In this context, the resources allocated to technology development and innovation support for large enterprises will be increased and diversified. These companies will also be encouraged to take on leadership roles in digital and green transformation projects. Furthermore, large enterprises will be supported in establishing global partnerships and expanding their presence in international markets.

Local Development Move

As part of efforts to promote local and regional development, the "Local Development Move Program" will be launched to identify and capitalize on regional opportunities and explore openings into new industries. Implemented under the new incentive system, this program aims to leverage regional potential, activate idle resources, mobilize capabilities, meet local needs, enhance regional technological and productive capacity, and accelerate sector-based development across provinces.

Under the Local Development Move Program, a limited number of high-priority investment topics with strong province-wide impact will be identified in each province and supported through specific call periods.

With the active involvement of development agencies operating in 26 regions and investment support offices established in 81 provinces, these investment themes will be updated annually, ensuring the creation of a dynamic and sustainable framework for local development.

155. **"Gazelle firms," which are high-growth enterprises, occupy a special place in the industrial ecosystem and access to support by these companies plays a vital role in growth strategies.** The rapid scaling of these firms significantly contributes to economic dynamism and employment. Gazelle firms that consistently meet performance criteria should benefit from support mechanisms more advantageously. This will ensure that resources are directed toward firms that generate high productivity and added value. By contrast, firms that consistently underperform despite benefiting from support mechanisms should not be kept artificially afloat. Instead, they should be included in processes of productive transformation within their sectors. This approach will promote the effective use of resources and support the healthy development of the industrial ecosystem. To support and monitor gazelle firms, a comprehensive data infrastructure will be established, and their growth trajectories will be regularly reported. In this way, enterprises with high growth potential within Türkiye's industrial ecosystem will be supported more effectively.

156. **In line with the vision of the National Technology Initiative, a new financing model tailored to the dynamics of industry and going beyond traditional banking approaches must be developed to support industrial transformation and direct investments toward critical technologies.** This new model, which is distinct from conventional banking, should be specifically designed to meet the needs of the industrial sector and offer solutions that reflect sectoral diversity. Strengthening the link between finance and production will support the industrial ecosystem and accelerate economic growth. In particular, development and investment banking instruments—especially project financing—will play a critical role in realizing large-scale investments focused on high technology, innovative production, and sectoral transformation. Providing long-term, low-cost financing for industrial investments aligned with digital transition and green production goals will be decisive in securing a sustainable competitive advantage for Türkiye's production ecosystem.

157. **One of the most pressing structural barriers to SME growth is limited access to finance, which restricts their potential for expansion, innovation, and competitiveness.** Issues such as insufficient collateral, high financing costs, and complex procedures make it difficult for SMEs to access financial resources. This, in turn, hinders their ability to scale up, enter new markets, and pursue strategic investments. Therefore, simplifying, streamlining, and improving the accessibility of existing support mechanisms is of great importance. Expanding credit guarantee schemes and enhancing their capacities will provide easier access to finance for firms facing collateral constraints. In addition, introducing financial technology-based solutions will promote quicker access to modern financial tools by SMEs, thereby optimizing resource use and enhancing flexibility within the production ecosystem. Such arrangements will not only address the short-term financing needs of SMEs but also support the implementation of their growth strategies and their contributions to sectoral transformation.

Regional Development

158. **The economic transition that Türkiye experienced after 1980, along with the accelerating process of urbanization, has deeply influenced the dynamics of regional development.** In particular, the significant migration from rural to urban areas between the 1980s and 2000s led to a rapid population increase in metropolitan cities. The concentration of industrial investments in the Marmara and Aegean Regions constrained opportunities for economic and social development in relatively less developed regions such as Eastern and Southeastern Anatolia. Although infrastructure projects and incentive policies pursued by the state during this period constituted important steps toward addressing regional disparities, the limited scale of industrial and technological investments hindered the achievement of long-term results.

159. **The shift in regional development policies during the 2000s has played a major role in reducing disparities among regions.** According to data from the TurkStat, the income gap between the highest- and lowest-income regions, which exceeded 4.8 times in 2004, dropped below 4.2 by 2023. Investments in transport and energy infrastructure, along with the expansion of education and healthcare services across the country, have been instrumental in this convergence process. In particular, the establishment of development agencies and the promotion of local projects through these agencies and regional development administrations have played a crucial role in tapping into local potential. Nevertheless, sustaining these policies over the long term is essential to reduce regional disparities in Türkiye. It has become

increasingly evident in this period that regional development is significant not only for economic growth but also in terms of social resilience and cohesion.

160. **In line with global trends and national priorities, the National Strategy for Regional Development (BGUS) has been developed, and 26 regional plans have been put into implementation at the regional level.** The primary objectives adopted for the upcoming period in regional development include strengthening the global economic integration of regions, enhancing their competitiveness, ensuring economic and social convergence, and enabling post-disaster recovery. In the implementation of these plans and strategies, public and private sector investments, the support and activities of development agencies and regional development administrations, and centrally coordinated thematic regional development programs will serve as key instruments.

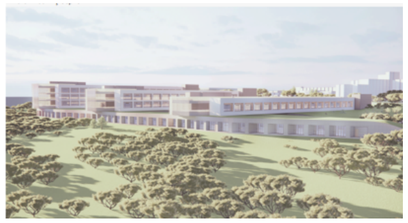
161. **Aligned with BGUS and regional plans, the Southeastern Anatolia Project (GAP), Eastern Anatolia Project (DAP), Eastern Black Sea Project (DOKAP), and Konya Plain Project (KOP) Action Plans will prioritize rural development, which is a vital component of regional development efforts.** Supporting agriculture and livestock farming in rural areas will contribute to revitalizing local economies and ensuring food security. By promoting modern agricultural techniques, sustainable production methods, and organic farming practices, the productivity of the agricultural sector should be increased. In addition, rural development projects should aim to enhance access to infrastructure, education, and healthcare services in rural areas, thereby improving the quality of life for rural populations. Logistics investments also constitute a vital component of regional development strategies. Achieving structural change in the manufacturing industry and improving logistics infrastructure will foster economic integration across regions. Strengthening organized industrial zones (OIZs) will help increase industrial production capacity. Moreover, the establishment of logistics centers and the improvement of transportation infrastructure will enhance the competitiveness of regional economies.

162. **Regional and local development strategies should be designed and implemented in alignment with the National Technology Initiative.** This initiative, which aims to secure Türkiye's technological independence, is of critical importance for increasing local production capacity and implementing innovative solutions. Accordingly, regional and local development strategies should be built on the unique dynamics and potential of each region, in a manner consistent with the National Technology Initiative. Encouraging youth participation in the entrepreneurial ecosystem is particularly vital for the success of regional development strategies. These efforts will support the dynamic structures of local economies and promote sustainable development.

163. **The recently adopted Local Development Move has introduced a new vision and dimension to regional development.** Within this vision, a wide range of projects are being developed—from agriculture and livestock to renewable energy, rural tourism, and the preservation of cultural heritage. Coordinated by the Ministry of Industry and Technology, these projects aim to ensure more efficient use of local resources and to achieve sustainable development goals. Moreover, the integration of regional development policies with cultural and environmental sustainability enhances the long-term impact

of these projects. The Local Development Move also provides a mechanism that strengthens collaboration between the central government and local actors.

Industry and Technology Colleges



Industry and Technology Colleges will contribute to training the qualified workforce needed by industry, facilitating access to young talent for companies, and fostering innovation in the industrial sector. From a national economic perspective, these colleges will increase the share of domestic labor in high-tech production, support high value-added manufacturing, and strengthen OIZs. Their educational model will be shaped through the support of production and education stakeholders, with an innovative structure focused on science and technology education, geared toward employment and vocational training. These colleges, operating in direct interaction with industry, will place emphasis on practice- and project-based learning, aiming to equip students both academically and professionally through industry-oriented programs. Their sustainability will be ensured through university-industry joint projects, scholarship and support programs for students, international education and industrial partnerships, and mentoring and career development programs.

164. **Smart specialization strategies are among the key priorities for the new era of regional development policies.** These strategies aim to identify the unique potential of local economies and enhance specialization and competitiveness in these areas. Smart specialization strategies will be developed by taking into account the natural resources, agricultural potential, industrial infrastructure, and tourism opportunities across Türkiye's various regions.

165. **Programs designed for regional development will continue to be implemented—centrally planned and managed, yet locally delivered through development agencies.** The Attraction Centers Support Program, implemented in 11 provinces, aims to revitalize economically stagnant regions and strengthen production infrastructure. As a result, provinces positioned as regional hubs have increased their capacity in production, employment, and exports. In the same vein, the Productive Cities Program seeks to enhance the industrial and technological infrastructure of 13 provinces, thereby boosting the international competitiveness of local economies. Meanwhile, the Social Development Support Program facilitates the

integration of disadvantaged groups into economic life and strengthens social solidarity at the local level. These programs will continue to be implemented in collaboration between development agencies and local administrations.

Resilience to Natural Disasters

166. **Given its geographic location, Türkiye is particularly vulnerable to natural disasters. The twin earthquakes centered in Kahramanmaraş on 6 February 2023 caused immense devastation.** These earthquakes inflicted severe damage across the provinces of Kahramanmaraş, Hatay, Malatya, Adıyaman, Gaziantep, Adana, Diyarbakır, Şanlıurfa, Kilis, and Osmaniye, leading to the collapse of thousands of buildings. Tens of thousands of people lost their lives, and hundreds of thousands were injured. This disaster once again highlighted Türkiye's vulnerability to natural disasters and the critical importance of disaster management processes. This is why, special emphasis must be placed on disaster management and recovery processes within both industrial and regional development strategies. Reducing disaster risks, enabling rapid recovery after disasters, and effectively managing socio-economic rehabilitation processes are crucial for the sustainability of regional development. To this end, infrastructure investments in high-risk areas will be scaled up, and resilience and preparedness capacities will be reinforced in the coming period. Similarly, disaster management capacity will be strengthened and domestic capabilities in disaster-related technologies developed in order to establish a resilient and prepared structure.

167. **Steps to enhance the resilience of industrial infrastructure against natural disasters constitute an integral part of the priorities outlined in this document.** In particular, relocating industrial areas in high-risk areas to safer locations will accelerate post-disaster economic recovery and minimize production losses. In this context, under the coordination of the Ministry of Industry and Technology, risk assessments of industrial zones will be conducted, and site selection processes will be carried out accordingly. Moreover, new industrial zones will be designed in accordance with disaster-resilient infrastructure standards, and structural reinforcement works will be completed to improve the resilience of existing zones. This process is of critical importance not only for the sustainability of economic activity but also for preserving employment and income sources in disaster-affected regions. Ensuring disaster-resilient industrial infrastructure will remain a foundational priority for achieving sustainable development in Türkiye.

Data-Driven Decision-Making Processes

168. **Data-driven decision-making plays a pivotal role in enhancing the effectiveness of industrial and technology policies.** Accordingly, a Data Analytics Center will be established in the coming period. The center will provide a comprehensive data infrastructure and analytical framework encompassing input-output analyses, international trade data, and sectoral growth dynamics. By offering advanced capabilities in big data analytics, machine learning, and data mining, the center will support policy-makers in making informed and timely decisions. In parallel, through the Electronic Study and

Research Center (e-ÇAM) platform, secure and privacy-compliant access to data will be facilitated, and the adoption of data-driven analytical tools will be promoted. Strengthening data and analytical capacity will be a key enabler for aligning industrial policies with strategic objectives.

169. **The success of industrial policies is directly linked to monitoring the economic and strategic impact of support mechanisms.** Databases such as the Entrepreneur Information System and the Industrial Registry System provide essential infrastructure for conducting impact assessments and yield actionable insights for policymakers. In this regard, data and analytics infrastructure will be expanded to support total factor productivity (TFP) measurement, input-output analyses, and the monitoring of dynamic changes across sectors and firms. Big data and artificial intelligence-powered decision support systems will also be established. Partnerships with international organizations such as the World Bank, OECD, and the Asian Productivity Organization will be strengthened to enhance knowledge exchange and international cooperation. A robust monitoring and evaluation system will contribute to the continuous improvement of industrial policy, boosting resource efficiency and elevating global competitiveness.

Inclusive Employment and Skills Matching in Industry

170. **Fostering inclusive employment across the industrial sector is one of the key objectives of Türkiye's industrial and employment policies.** To achieve this, efforts will focus on skills mapping, labor demand analyses, university-industry collaborations, and efforts for boosting the participation of women and young people in industrial employment, taking into account international best practices. It is essential to develop models tailored to Türkiye's context to enhance women and youth employment and strengthen inclusion in industry. In this regard, the construction of housing in OIZs, creation of social spaces for young workers, and provision of daycare and study center services will contribute to sustainable employment.

171. **Numerous countries have adopted a series of strategies to promote skills matching.** Skill mismatches pose a significant challenge to productivity and competitiveness in the industrial sector. These mismatches arise when the skill sets of the workforce do not align with the demands of industry. Germany's Dual Education System offers a model example, providing students with both theoretical and practical training tailored to industrial needs. This is how the qualified workforce needed by the industry is cultivated. Through internships during their education, students are better prepared for employment opportunities upon graduation. This approach may inform similar efforts in Türkiye to identify critical skill needs and align workforce training accordingly. Accordingly, there are plans for establishing science, technology and vocational training focused Industry and Technology Colleges in the coming period. These institutions will provide students with a strong theoretical foundation alongside opportunities for hands-on learning.

Goal 5. Addressing productivity, capacity, and scale-related challenges in the manufacturing industry, and enhancing resilience to crises and external shocks

Strategies

Strategy 79	Industrial zones will be expanded in line with the National Master Plan for Industrial Areas.
Strategy 80	As part of the National Master Plan for Industrial Areas, industrial sites located in regions with high seismic and disaster risk will be relocated to safer areas, and production and employment corridors will be established to foster the clustering of industry in secure areas.
Strategy 81	Railway and port connections, along with the physical, technical, and financial infrastructure of OIZs, will be strengthened.
Strategy 82	To enhance the logistics infrastructure of OIZs, alternative financing mechanisms, particularly public-private partnerships, will be developed to encourage private sector investment.
Strategy 83	Disaster management technologies will be developed to establish a structure that is resilient and well-prepared for natural disasters.
Strategy 84	The new Investment Incentive System will simplify tools and processes, and a more selective approach will be adopted for the evaluation of investment projects.
Strategy 85	Strategic governance mechanisms will be established to monitor field-level data and developments in productivity. Sector- and firm-based analytical assessment systems will be developed to identify productivity issues in manufacturing, and data-driven solutions will be formulated accordingly.

Strategy 86	The number of Model Factories will be increased, their institutional capacities will be strengthened, and their roles as productivity interfaces will be expanded.
Strategy 87	Under the Local Development Move, support mechanisms will be established to tap into local potential, mobilize idle resources, enhance production and technology capabilities, and improve the quality of the local workforce, thereby increasing regional production capacity.
Strategy 88	Support will be provided for SME scale-up investments and for developing suppliers of large enterprises. Platforms will be established where leading, large-scale, and specialized firms take the lead in strengthening their local production ecosystems.
Strategy 89	Development and investment banking tools, especially project financing, will be employed to meet the financial needs of the industrial and technology ecosystem, and stronger, more functional links will be fostered between the financial sector and industry.
Strategy 90	Support mechanisms offered by KOSGEB for SMEs will be made more streamlined, accessible, effective, and impactful.
Strategy 91	Fintech-based financing models will be promoted to improve SMEs' and entrepreneurs' access to finance. Credit guarantee mechanisms will be expanded and made more accessible to address the collateral challenges faced by SMEs.

Strategies

Strategy 92	Dedicated mentor pools will be established to support the implementation of innovative business ideas—particularly those by women and young entrepreneurs. Accelerator programs, microcredit schemes, and prototype development grants will be made available.
Strategy 93	A monitoring infrastructure will be developed to support the rapid growth of gazelle firms, enabling them to benefit more substantially from support and incentive programs.
Strategy 94	To promote more efficient use of national resources, businesses that have persistently underperformed over the past three years will be included in sectoral transformation.
Strategy 95	Dedicated sites for technology-oriented enterprises above a certain scale will be created in selected OIZs. Modular industrial facility designs will be introduced to allow firms to expand production space in line with their growth.
Strategy 96	Infrastructure for standardization, conformity assessment, certification, and testing laboratories will be reinforced to also serve neighboring countries. The Turkish Standards Institution (TSE) will become more efficient and competitive.

Strategy 97	The data and analytics infrastructure will be expanded to support TFP measurement, input-output analyses, and the monitoring of transformation dynamics at the sectoral and firm level. Big data and AI-based decision support systems will be established, and partnerships with organizations such as the World Bank, OECD, and Asian Productivity Organization will be strengthened.
Strategy 98	Impact assessment mechanisms will be developed to measure the contribution of industrial policies to strategic goals, focusing on productivity, scale, production capacity, and global integration.
Strategy 99	To ensure skills matching across the industrial sector, labor market demand will be analyzed on both sectoral and regional levels. Based on these analyses, vocational training, guidance, and capacity-building programs will be implemented to address gaps in workforce qualifications.
Strateji 100	New regulations and supportive programs will be introduced to facilitate the participation of women, young people, and foreign workers in production processes. Inclusive employment will be supported by enhancing housing, childcare, study centers, and social facilities in OIZs.

MONITORING AND EVALUATION

The 2030 Industry and Technology Strategy seeks to strengthen Türkiye's position as a competitive and resilient actor in the domains of high technology, digital transformation, green transition, and global integration. Anchored in the vision of the National Technology Initiative, the Strategy aims to accelerate the transformation of the industrial ecosystem in these critical areas. Ensuring the success of this structural transformation requires not only the formulation of sound, coherent, and inclusive policies but also their effective implementation, systematic monitoring, and rigorous evaluation.

Accordingly, the Strategy has been developed through a transparent and participatory process, underpinned by the principles of accountability and stakeholder engagement at every stage. This participatory approach will be sustained throughout the implementation and monitoring phases. The active involvement of all relevant organizations and stakeholders will be ensured to facilitate coordinated and result-oriented action.

The Directorate General for Strategic Research and Productivity (DG SRP) within the Ministry of Industry and Technology will serve as the Secretariat responsible for managing the monitoring and evaluation framework. The Secretariat will coordinate all administrative and reporting activities associated with this process. Twice annually, in January and July, the Secretariat will receive the progress information and data officially pertaining to the preceding six-month period from the relevant units and institutions. Based on the information and data gathered, it will produce a comprehensive Monitoring and Evaluation Report. The finalized report will be submitted to the Minister of Industry and Technology in February and August each year.

JANUARY and JULY (Annually)

DG SRP formally requests progress reports from the relevant units and institutions and agencies concerning the implementation of the strategies.

JANUARY and JULY (Annually)

Relevant units and institutions submit their progress reports to DG SRP regarding the implementation of the strategies.

FEBRUARY and AUGUST (Annually)

Based on the submitted progress data and the current status of macro-level objectives, DG SRP prepares a biannual Monitoring and Evaluation Report and presents it to the Office of the Minister of Industry and Technology.

MARCH and SEPTEMBER (Annually)

The Governance Committees of the Ministry of Industry and Technology review and evaluate the progress made in relation to the strategy document.

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2030
INDUSTRY AND TECHNOLOGY STRATEGY

Republic of Türkiye
Ministry of Industry and Technology

The Directorate General for
Strategic Research and Productivity

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