TURKISH ERA ROADMAP

National Roadmap on European Research Area

May 2019

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From its early years onwards the Turkish Research Area (TARAL) is formulated in consideration of global trends including latest European Science, Technology and Innovation Policy (STI) perspectives. The European STI Policy objectives and processes shed light to the Turkish Research Area principles. European Research Area (ERA) priorities are complementary to TARAL's functions at various levels and capacities, from policy design to implementation.

TARAL's operational structure was set-up in 2004, in line with ERA principles; with the aim of eliminating duplications and reducing fragmentation among research efforts. It aims to initiate research and innovation based economic development in Turkey and revolves around four main objectives: increasing welfare and life quality of citizens, proposing solutions to societal problems, increasing competitive power of Turkey and disseminating science and technology culture in society.

Recently, measures taken towards reforming research and innovation system gained greater momentum in Turkey. EU- Turkey cooperation via integration into the European Research Area and enhanced participation in EU Framework Programmes are grasped as the core components of this new reformist vision. Within the context of increasing the effectiveness of national research system, investment in research and innovation is growing together with the number of researchers and R&D personnel. Moreover, novel initiatives are put in place by TÜBİTAK to realize an output oriented innovation ecosystem.

In this respect, the system is being reformed through a new set of actions and programmes:

- Bringing volume to Mission-oriented R&I programmes
- Triggering competition among research universities for output oriented research and attracting qualified human resources
- Increasing researchers' mobility and mission oriented development of human resources capacity
- Enhancing human resources capacity and quality in research centres

Convergence to ERA Priorities is and will be of utmost importance in research and innovation agenda within the context of the new momentum in Turkey. Joint efforts and active engagement of research and innovation actors are crucial to strengthen TARAL and facilitate alignment with Europe.

The **National ERA Roadmap** below aims to lay down the basis for further implementation of ERA Priorities in Turkey in close cooperation with all relevant stakeholders. The measures included will constantly evolve in order to address the changing conditions of research and innovation environment in Turkey and Europe in high degree of cooperation and participation.

The National ERA Roadmap is based on the conclusions of:

- Conference on Turkish Universities in the European Research Area, held on 8-9th of October 2015 in Ankara
- Workshops realized on ERA Priorities on 4th of November 2016 in Ankara
- The Meeting on Building the European Research Area in partnership with Turkey on 24th November 2016 in Brussels
- The Meeting on Building the European Research Area in partnership with Turkey on 16th of November 2017 in Istanbul
- ERA Progress Report, Turkey Snapshot, 2016

This Roadmap aims to further encourage joint activities among Turkish and European stakeholders to bring forth the importance of exchanging recent ERA, TARAL and research and innovation policy developments with a view to promote convergence and reciprocity of research and innovation policies between Europe and Turkey.

A closer linkage among ERA and TARAL is vital to ensure that research systems in Turkey and the EU can jointly address societal challenges and contribute to lasting economic growth and competitiveness. In this respect, EU Framework Programmes play a vital role to facilitate the alignment of ERA and TARAL, to support joint research efforts, to increase researchers' mobility and to develop long lasting partnerships among researchers.

Objectives and Measures towards ERA Priorities

This Roadmap took stock of the advancements made on each of the 6 ERA priorities, and of the current level of research and innovation cooperation between Europe and Turkey. The discussion tackled ways to strengthen the cooperation between research and innovation, including adequate framework conditions, in particular through open science, open innovation and open to the world.

It aims to strengthen commitments of all stakeholders to intensify and accelerate the alignment of ERA and TARAL based on the following principles:

ERA Priority 1: More Effective National Research Systems,
ERA Priority 2: Optimal Transnational Cooperation and Competition including 'optimal transnational cooperation and competition' and 'Research Infrastructures
ERA Priority 3: An Open Labour Market for Researchers
ERA Priority 4: Gender Equality and Gender Mainstreaming in Research
ERA Priority 5: Optimal circulation and transfer of scientific knowledge including "Knowledge Circulation and "Open Access"
ERA Priority 6: International Cooperation

The objectives and measures described within individual ERA Priorities aim to facilitate and accelerate the efforts of all concerned Turkish and European stakeholders for integration of TARAL and ERA. The Scientific and Technological Research Council of Turkey (TÜBİTAK) is affiliated with the Ministry of Industry and Technology. As the leading agency for management, funding and conduct of research in Turkey, TÜBİTAK initiated the preparation

of the National ERA Roadmap for Turkey. This Roadmap entails framework objectives to shed light for further joint efforts among Turkish STI actors in a wider context including national authorities, research organizations and universities. The integration of TARAL and ERA as the main aim of this Roadmap is crucial to secure a vibrant research environment, a strong research capacity and a stable scientific infrastructure where researchers and knowledge can circulate freely.

ERA Priority 1: More effective national research systems

Investments on research and innovation is growing in Turkey to produce and practice quality research. According to the statistical data from the "Research and Development Activities Survey, 2017" of the Turkish Statistical Institute (TÜİK), gross domestic expenditure on research and development has an increase of 5% in 2017 compared to 2016 which means an amount of 5 billion 214 million TL increase was realized leading to 29 billion 855 million TL in 2017 (with 2018 constant prices).

The share of R&D expenditure in Gross Domestic Product (GDP) also increased. While gross domestic expenditure on research and development (GERD) in GDP was 0.94% in 2016, it increased to 0.96% in 2017.

Total number of full time equivalent (FTE) R&D personnel was 153,552 in 2017. Annual increase in FTE R&D personnel was 12% compared to the previous year. Regarding FTE R&D personnel distribution by sectors, 57.3% was employed in financial and non-financial corporations, 35.4% was employed in higher education and 7.4% was employed in general including governmental organisations, private non-profit organisations in 2017 [8].

Considering the patent statistics of Turkey, the total patents granted has reached to 11,074, marking an 8% increase compared to the previous year. The foreign patents granted are 9,280, which corresponds to approximately an 11% increase compared to the previous year.

Resources dedicated to R&D will be maintained and increased in order to achieve a vibrant research environment through mission oriented funding, developing frontier research skills, strengthening fundamental research base, supporting excellent research clusters, enabling strategic international cooperation in research and innovation. A transparent and participatory research and innovation governance will be established for a more effective national research system. A culture of enhancement will be fostered through dialogue and cooperation towards alignment with ERA priorities.

Objective 1.1: Increasing mission oriented funding

Mission oriented programming and funding in research is at the forefront of addressing current and forthcoming technological and societal challenges with confidence and commitment. In order to achieve mission oriented R&I, a theme-based programme management model is applied.

In the technology prioritization analyses of TÜBİTAK, over 12,000 suggestions have been collected from 8,000 experts in universities, private sector firms, public sector institutions

and non-governmental organizations with 5,500 experts participating in Delphi surveys and 681 experts in focal groups. TÜBİTAK has actively developed technology roadmaps to address national priorities that pertain to high value-added technologies and related advances. To date, TÜBİTAK has developed technology roadmaps based on the Delphi method covering energy efficiency, mobile communication technologies, MEMS/NEMS, LED/OLED and screen technologies, biomaterials, biomedical equipment, medicine, vaccines and diagnostic medical devices, embedded systems in the automotive and machinery sectors and light-weight materials in the automotive sector. Most recently, technology roadmaps are being developed based on the technology groups of factories of the future, digitalization and interaction within the scope of smart manufacturing systems with 8 critical technologies and 29 critical products. Technological prioritization analyses continue with a focus on product groups of intermediate products and digital transformation, including internet of things, sensor technologies, smart automation technologies, robotics, data analysis and artificial intelligence, augmented reality, cloud technology and additive manufacturing.

Starting from 2012; two new result driven and targeted call based programs have been designed and are in the process of being launched by TÜBİTAK. Numerous other need analyses and technology roadmap studies have provided input to the call based target-oriented support mechanisms of TÜBİTAK; namely "The Support Programme for Research, Technological Development and Innovation Projects in Priority Areas (TÜBİTAK 1003)" and "The Support Programme for Research, Technological Development and Innovation Projects in Priority Areas (TÜBİTAK 1511)". Calls are launched in each sector including social sciences through these support programmes. Research consortia which are composed of academic and industrial organizations are supported in prioritized sectors.

Call topics for every 2 years are and will be adopted in priority sectors such as Chemistry, Pharmaceuticals, Automotive, Semi-Conductor based Electronics, Food, Machinery, ICT and digital transformation of industry. The call topic contents are and will be formulated and scheduled in line with Horizon2020 calls. Increased resources will be allocated to mission oriented programmes and participation of international experts to evaluation panels will be enhanced.

Efforts to better align national call topics with Horizon 2020 priorities, to apply the core principles of international peer review and to find a satisfactory balance between competitive and bottom-up funding will be accelerated.

Moreover, "100/2000 YÖK (CoHe) Doctoral Scholarship" was designed as a long term Project with a participatory approach to increase the number of PhD-level human resources in the prioritized fields. In this respect, CoHE announced a call for application to universities offering scholarships to students in 100 thematic fields in the areas of "Fundamental Sciences and Engineering", "Health", "Social Sciences" and "Architecture and Design". The aim of the project is to create a competitive environment based on the fields of specialization in state universities, to produce knowledge in priority fields and to promote universities within the scope of the project.

Objective 1.2: Output oriented research and innovation interactions will be fostered

In order to enhance output oriented interactions, the "High Technology Platform Call" under the Support Programme for Centres of Excellence (TÜBİTAK 1004) has been launched by TÜBİTAK. This Programme supports key enabling technology hubs composed of Research Universities, specialized Research Infrastructures (RIs) and industrial partners. Within the hubs, research results are expected to translate into commercial products and services. Those hubs are expected to present ERA and Horizon2020 focused actions in their proposals.

The program is anticipated to pave the way for specialization of Research Infrastructures via Big Scale R&D Projects. The research centres which have been established through public funds and accredited within the scope of Law No. 6550, as well as the research centres of "Research Universities" which are announced by the Council of Higher Education will be provided the opportunity to acquire large-scale R&D project support from TÜBİTAK in order to specialize in a thematic field and to become sustainable high technology hubs in Turkey.

The program is expected to highly contribute to the efficient use of research infrastructures and encourage their sustainability based on their specialization in a scientific and technological field and increase their collaborations with industry.

Objective 1.3: Smart Specialization of Universities will be supported

The alignment of strategic research agendas of universities with prioritized sectors, ERA objectives and Horizon 2020 is crucial on the level of scientific research. TÜBİTAK's "R&D Strategy Document Development and Implementation Programme" call under the TÜBİTAK 1000 Programme is designed to allow universities to develop their strategic R&D priorities through research agendas. They need to exhibit their ultimate research outcome & the expected added value to the market. Universities are expected to focus on research areas prioritized under EU Framework Programmes and the National Research and Innovation Agenda. This call aims to differentiate major activity areas of universities based on their existing infrastructure and academic excellence and enhance their specialization. Within the frame of this call, universities are required to apply with their initial plans to develop an R&D strategy and the list of technological areas they are dedicated on becoming specialized at.

TÜBİTAK has realized a "University Competency Analysis" in order to evaluate the applications to the 1000 Programme and to determine the research competencies of universities. The analysis included extensive bibliometric analyses of 143 universities in 120 research areas with 12,000 unique keywords. The indicators that have been used, among numerous other indicators, are total publications of the university in comparison to the total publications overall, relative citation index, number of authors and R&D grant data. According to these analyses, the competency maps of universities and research areas have been obtained. The results have been used to provide guidance to the evaluation stage of the 1000 Programme. In this way, the universities will be directed to specialize in areas of their competence rather than seeking to specialize in all areas that may already be more readily addressed in other universities.

Objective 1.4: Creation of specialised technology and Innovation Hubs will be supported

To boost production and commercialization of high-tech products, "The Industrial Innovation Networks Mechanism (SAYEM)" has been launched. The main aim of the programme is to support high Technology Readiness Level (TRL) activities of consortia led by industry and formed with participation of other firms of the value chain of the targeted technology-based product; together with end-users, technology development zones and universities.

The Industrial Innovation Networks Mechanism is characterised by several features:

- The networks target the convergence of actors on both ends of the technology development and commercialization spectrum. Researchers of high value-added technologies and products will interact with end-users in a way so as to accelerate the commercialization process across the supply and demand sides.
- The targeted TRL will be between TRL 5 or 6 and 9, thereby targeting technological innovation that is closer to the market.
- Within the frame of both the TÜBİTAK 1004 High Technology Platforms Call and "the Industrial Innovation Networks Mechanism (SAYEM)", the networks will be established in two phases. In the first phase, the support grant will be directed to establishing models of cooperation and networks based on a roadmap and a business model. In the second phase, the support grant will be provided for implementing the R&D and innovation activities that take place in the roadmap and strategic milestones that have been put forth by the actors who are involved in the network for co-creating high value-added products.

Moreover, technology based start-ups, TTOs and mentorship as innovation interfaces are being supported. On top of that, "Tech-InvesTR Venture Fund Support Programme" has been launched by TÜBİTAK. It is designed to provide the capital required for early stage corporates, like SMEs, in the process of commercialization of their newly developed R&D products and technologies.

Objective 1.5: Increasing participation to Horizon 2020 Programme

Increasing the participation in H2020 is expected to make a leverage effect for a strong integration into ERA. Horizon 2020 is and will be of high priority in the research and innovation agenda within the context of the new momentum in research and innovation in Turkey. As emphasized in the ERA Progress Report Turkey Snapshot 2016, participation in EU Framework Programmes serves for the improvement of innovation performance.

In this respect, current level of participation to Horizon 2020 will be increased via dedicated national coordination activities and restructuring of national programmes in line with Horizon 2020 and ERA priorities.

Core functions of TÜBİTAK as the National Coordination Office of Turkey revolve around network building, guiding, consulting, partnering, and proposal support activities targeting Turkish research and innovation actors.

Trainings, project writing camps, info-days, brokerage events at both national and international levels are being organized for targeted calls. Between the years 2014-2018 around 1.200 events have been organized and a total of more than 40 thousand researchers and innovators participated in the events. Additionally, one to one consultancy is being provided to researchers and innovators to tackle the specific cases of their project applications. Info-days, brokerage events, trainings and tailored support for individual will be maintained to increase awareness among Turkish research and innovation actors.

In order to encourage participation in the Programme, Horizon 2020 Support and Award Programmes are being implemented. These Programmes aim to facilitate the entrance of new actors to the Programme, enhance the number of project applications, raise the quality of project proposals, and increase the number of project coordinators. Award Programmes aim to motivate Turkish actors' participation in H2020. There are four types of supports namely; Travel Support, Coordinators Support, ERC Principle Investigator Support, and the MSCA Pre-Evaluation Support. There are also three types of awards that can be earned, these are namely the Above-Threshold-Award, the Success Award and the COST Action Award. Current Support and Award programmes will be enriched in order to address the evolving structure of EU FPs and needs of TARAL actors.

Target oriented international workshops are and will be realized to help potentially strong and matching research groups of Turkey and Europe so that they can develop joint project proposals, either in Europe or Turkey. Mapping exercises are carried out for selected calls for proposals to identify potentially successful institutions in Turkey and Europe. Then, Joint workshops are organized between potentially successful and matching institutions either in Turkey or the Country of the selected European Institution. Between the years 2014-2018; 30 international workshops have been organized in thematic fields including, ICT, NMP, Health, Social Sciences, Energy, Environment in either in Europe or Turkey.

An Information Multiplier System (IMS) has also been established in Turkey. IMS was established with 75 multipliers who were trained to act as intermediaries and to be able to provide information, organize trainings and support potential participants of Horizon 2020. They are composed of TTOs, techno parks, universities, chambers, development agencies, research centres and business organizations. The number of multipliers will be increased to 100 in order to achieve a greater diffusion of information to new actors locally.

Also, creation of national technology initiatives and technology platforms are fostered to establish national consortia to strengthen participation in possible Horizon 2020 projects. Some examples to those national initiatives are 5G TR Forum, Smart Mobility, Robotics, and Cybersecurity mirror PPPs. From 2019 onwards, Horizon 2020 focused national technology initiatives will be launched namely: Quantum Science and Technologies, Security Research, Migration Research, Personalized Medicine and Battery Technologies. Furthermore, National calls for proposals are being structured in line with Horizon 2020 both in terms of content and timing.

Technical Assistance for Turkey in the Horizon 2020-Phase II project (funded by Instrument for pre-Accession) was launched in January 2019. It aims to strengthen the capacity of Turkey in Science, Technology and Innovation and facilitate the integration of TARAL to ERA

through increasing its participation in Horizon 2020. The purposes of the project are as follows:

- Maintaining the knowledge diffusion established in the previous project
- Raising awareness on Horizon 2020 via a variety of trainings
- Providing the Turkish Research Area with networking events, activities, project documents and online tools through dissemination of the information.
- Knowledge Diffusion on the Next Framework Programme

The project aims to increase the level of awareness and attractiveness of the H2020 and the Framework Programmes in general, through a fully efficient Information Multipliers System, training and project writing camps and an SME support package. Furthermore, the participation and success rate of Turkey in H2020 is planned to be increased from 2000 to 3500 applications through 2 International Brokerage Events, annual award ceremonies, study visits and national advisory meetings. Moreover, knowledge diffusion on the 9th Framework Programmes (Horizon Europe) will be realized via a launch conference and info days. Last but not least, the sustainability and dissemination of project results will be achieved through the preparation and printing of project documents and informing via the web site. The project is planned to be finalized on the 6th of January 2022.

Universities and industrial organizations are expected to put forth their vision, institutional ownership and commitment towards increased participation in Horizon 2020 and alignment with ERA priorities via increased participation in ERA related platforms and partnerships. Universities will be further encouraged to develop a dedicated Horizon 2020 agenda to convene and coordinate multi-disciplinary interest groups and catalyse new cross-disciplinary research initiatives and teams in line with call topics. Universities vision will entail providing continuous feedback about latest research/innovation topics and tendencies in Europe and improve research groups' skills & interests for Horizon 2020.

A new governance structure is set up for H2020 with participation of related Ministries and national actors. This newly structured Monitoring and Steering Committee aims to enhance Turkey's participation in the Programme via qualified projects. This structure will be maintained to enable open discussion, high degree of cooperation and participation.

ERA Priority 2: Optimal Transnational Cooperation and Competition

ERA Priority 2a: Jointly Addressing Grand Challenges

Optimal transnational cooperation and competition is crucial to jointly address grand challenges. At the European scale, grand challenges are tackled by aligning the Joint Programming processes, defining and implementing common research agendas, and producing joint calls and projects. Turkey is already actively participating in many initiatives and enhancing cross-border collaboration at the European level.

Turkey has a long tradition of taking part in transnational cooperation at the European level. International collaboration is a focal point of the national STI practices and is enabled

through open calls as well as bi- and multilateral programmes. Turkey has continuously supported Joint Programming Processes since Framework Programme 6.

- Joint Programming Activities (JPI) are the policy tools developed to realize the European Research Area (ERA) and to conduct the coordination of Europe-wide science and technology activities with the funds allocated for R&D activities. Among the ten JPI's conducted Europe-wide, Turkey is involved in eight and among them holds an observer position in three. The JPIs that Turkey is involved in are; Neurodegenerative Diseases Research (JPND), Food Security, Agriculture, and Climate Change (FACCE), A Healthy Diet for a Healthy Life (HDHL), Antimicrobial Resistance (JPIAMR), Connecting Climate Knowledge for Europe (JPI Climate), Healthy and Productive Seas and Oceans (JPI Oceans), The Potential and Challenges of Demographic Change, Water Challenges for a Changing World (Water JPI) and JPI Urban Europe.
- European Research Area Networks (ERA-NETs) take an important place among instruments supporting the achievement of ERA objects as they provide the framework for coordinating and aligning national or regional research and innovation programmes. Turkey has participated in 8 ERA-NET networks in FP6, 53 ERA-NET and ERA-NET Plus networks in FP7 and is actively participating in 41 ERA-NET Cofund projects and 1 European Joint Programme Cofund project (EJP Rare Diseases) under Horizon 2020.
- Turkey participates in several Article 185 TFEU initiatives such as European Metrology Programme for Innovation and Research (EMPIR), Partnership for Research and Innovation in the Mediterranean Area (PRIMA) and Eurostars-2.
- Turkey continues to support Joint Undertakings (IMI-2, Clean Sky 2, FCH 2, SESAR, Shift2Rail, BBI) and have been a member state in ECSEL since 2017.
- Turkey is a member of EuroHPC and financially contributes to the achievement of the objectives of the Joint Undertaking.
- Turkey is also a founding member of EUREKA which aims to enhance European competitiveness by fostering innovation-driven entrepreneurship in Europe.

Turkey has a centralized structure for governing of Joint Programming Processes. TÜBİTAK is the leading agency to participate in P2P networks and disseminate information.

Objective 2a.1: Removing barriers to Joint Programming Process

In order to remove existing barriers that may be hindering participation into transnational networks and reinforce the research and innovation communities in Turkey, TÜBİTAK has redesigned national funding schemes to better suit transnational research collaborations.

TÜBİTAK 1509 International Industrial R&D Projects Grant Programme which focuses on supporting market oriented R&D projects such as ERA-NETs or EUREKA projects has been modified in order to align with international evaluation systems. The programme rules, national eligibility check procedures and timelines have been revised to remove procedural barriers. The TÜBİTAK 1071 Programme, which aims to enable targeted international cooperation and establish strategic R&D partnerships, offers a flexible instrument that can be tailored to the needs and conditions of a transnational call.

Another measure to better coordinate Joint Programming processes within TÜBİTAK is the establishment of a decision making board with the mandate to remove procedural obstacles and enhance communication of JPP. The Board will enable monitoring of the networks TÜBİTAK is participating in and develop strategies to set up priorities for transnational collaborations. One of the actions of the Board has been to gather data on P2P networks and projects in order to create and implement a JPP business intelligence system.

Objective 2a.2: Establishing and maintaining inter-institutional governance structure

Turkey will continue its efforts to promote the participation into trans-national networks and generate new collaboration opportunities among national authorities. Research and innovation programme owners' and managers' incorporation to related trans-national networks will be further promoted. An inter-institutional governance structure will be designed and implemented for coordinated action towards this aim.

Objective 2a.3: Maintaining active participation into trans-national networks

Proactive strategies will be implemented towards further encouraging national research and innovation actors to apply to the joint calls launched under trans-national networks. In cooperation with related research programme owners and managers in Turkey, a joint promotion strategy will be implemented. Potential national and European researchers will be identified, effective communication channels will be mobilized, info-days and brokerage events will be organized and partnerships will be promoted for winning proposals.

The above mentioned objectives are also based on the conclusions included in the final report of "Mutual Learning Exercise Alignment and Interoperability of National Research Programmes: national coordination, national preconditions and national governance structures, communication flows and visibility of JPP" produced in 2017.

ERA Priority 2b: Make Optimum Use of public investments in research infrastructures

The Research Infrastructures (RI) policy refers to investments in physical structures, knowledge based resources and the access services to these facilities. Therefore, RIs occupy a critical place in research and innovation systems as they allow the stakeholders to produce advanced scientific inputs and technological services. In this respect, RIs have the potential to help the community to tackle grand societal challenges as well as to create economic and social impact.

Turkey's alignment with ERA priorities in RI is particularly important, since RIs used to be covered within the scope of public sector investments which were subject to strict regulations and inflexible settings until recently. However new legislation (Law No. 6550 on Research Infrastructures) and good practices (TÜBİTAK 1004 Programme) have shown that increased budgets, managerial autonomy and performance based supervision are fruitful in creating the desired outcomes that RIs are expected to bring into the value chain.

Yet, there is still room for improvement in bridging the domestic RI governance with the Pan-European ESFRI structure. The domestic endeavours for closing this gap can be summarised under the four objectives addressed in this context.

Objective 2b.1: Establishing a performance based institutional assessment for efficient and sustainable research infrastructures

In order to establish new Research Infrastructures (RIs) and develop the existing ones, public support is being allocated through Investment Programs designed by the Presidential Office of Strategy and Budget. RI projects are selected through a competitive project call system in which projects are assessed by scientific panels. In this regard, up to now, nearly 7.4 Billion Turkish Liras have been allocated for establishment and development of RIs.

In 2014, Law of Supporting Research Infrastructures (Law No. 6550), a new performance based support system was established and in 2015 a secondary level legislation had been enacted. The main aim was to support RIs in order to ensure their sustainability and result in a more effective use through financial and administrative reforms introduced by the Law. The Law's main reform agenda is the provision of a more competent and flexible administrative capacity for the research centres established in the Turkish Universities. The main novelties brought by the Law No. 6550 can be listed as follows;

Status	From university affiliation to legal entity status
Effective management	• Board of Directors, Advisory Board and Directorate • Performance based work system
Employment of qualified personnel	• Contracted researchers and technical staff • Competitive Salary • Contractual flexibility
Sustainable financial structures	• Provision of core funding • Performance-based funding mechanisms • Autonomy for managing own budget and generating income • Tax exemptions and exceptions
Collaboration with stakeholders and accessibility	• Possibility to establish joint RIs with stakeholders (public institutions, private sector etc.) • Possibility to be located in in the industrial zones and private sector areas • Possibility to establish a commercial company or becoming a partner for existing companies • Continuous access to RIs • Possibility to establish Research Infrastructure Platforms

The main governing body in the implementation of the Law, is the Research Infrastructures Commission (RIC) which is authorized to determine research centres that can operate under this Law; regulate policies related with RIs, and supervise financial issues including the budget allocation. RIC is composed of

- Minister of Industry and Technology,
- Minister of National Education,

- Deputy President of Science, Technology and Innovation Policies Board,
- Deputy President of Education and Training Policies Board,
- Head of Presidential Office for Strategy and Budget.

Within the scope of the Law, university affiliated RIs are evaluated through site visits and expert panels in terms of research and management competency and critical importance for the country. The RIs that are decided to be granted a five-year legal status with a performance-based contract is monitored on an annual basis and are subject to an interim evaluation at the end of the third year. At the end of the fifth year, there is a re-evaluation process in terms of the past five-year performance for the continuation of the support given by the Law.

Based on the evaluation, among the six RIs evaluated by TÜBİTAK, four RIs have been accredited within the scope of this Law in 2017. For the four RIs listed in the table below, a performance based monitoring process was carried out and then the budgets of 2018 were transferred to these RIs.

Research Infrastructure	Research Area
Bilkent University UNAM National Nanotechnology Research Centre	• Nanoscience • Nanotechnology • Materials Science • Physics • Biology • Chemistry
Izmir Biomedicine and Genome Centre	• Cancer • Genetics and Genomics • Biopharmaceutical Production and Characterization • Cellular Therapy • Immunology • Bioinformatics
Sabancı University Nanotechnology Research and Application Centre	• Nanotechnology • Nanomaterials • Life Sciences • Energy, Water and Environment • Food and Agriculture • Biotechnology
Middle East Technical University MEMS Centre	• Image Sensors • Inertial Sensors • RF MEMS • Bio MEMS • Power MEMS • Vacuum Packaging • IC Design • New Areas • Fabrication

It is planned that a further 36 RIs will be evaluated in 2019, and those with sufficient qualifications are expected to be supported under Law No. 6550.

In order to increase the visibility, improve sustainability, and enable future planning of the current and future RIs, a National Research Infrastructures Roadmap is under preparation.

Objective 2b.2: Supporting RIs to transform into Centres of Excellence

TÜBİTAK has designed a new support mechanism for transforming infrastructures into centres of excellence. Within the frame of the program the centres are obliged to engage in collaborations with industry. This new support program is expected to bring a new insight into the specialization of RIs via Large Scale Projects towards becoming Centres of Excellence. The research centres, which have been established through public funds provided by the Ministry of Development at the time, will be provided with the chance to acquire large-scaled project support from TÜBİTAK, in order to specialize in a thematic field and become global centres of excellence.

To this end, the research centres are expected to build a consortium, including the private sector, to trigger the commercialization of research results. The centres will also have an industry steering board and are expected to enhance their international network, research capacity and human resources.

The program is expected to highly contribute to the efficient use of research infrastructures and encourage their sustainability based on their specialization in a scientific and technological field and increase their collaborations with industry.

Objective 2b.3: Creating synergies among RIs for increased effectiveness

Access to large-scale RIs is as critical as investing in the creation of new facilities. These infrastructures serve as centres of attraction for skilled researchers. RIs also enable addressing contemporary challenges and generating economic activity through multi-disciplinarity and access to state of the art machinery and other sources. Decision-making in RI investments is a compelling process since the required amount of investment for effective functioning on the RIs, extends the available financial resources of national authorities. Therefore, embracing a dynamic model is beneficial where the funding bodies and the RI managers act in order to create synergic collaborations. The investments should seek to serve national priorities and be in harmony with the international RI policy orientations at the same time. In this sense, an effective coordination system is required in order to ensure complementarity between domestic RI investment proposals with the existing national and international centres in terms of the themes covered and the administrative models in practice.

Objective 2b.4: Increasing international collaboration profile of RIs

Cost effectiveness and enhanced synergies between the national and international RIs can be achieved through the general framework provided by the ESFRI Roadmaps. This entails that the domestic investment decisions are made taking the ESFRI priorities into consideration and the national RI managers are made aware about the ESFRI structure as well as the H2020 call configuration which provides support for the creation and long-term sustainability of the ESFRI projects. Notable initiatives have been undertaken in this respect.

Taking into consideration that H2020-WIDESPREAD-04-2017-Teaming (Phase I) Call was designed specifically to address the need to establish new research infrastructures or improve the existing ones, TÜBİTAK and the Ministry of Development (now the Strategy and Budget Office) developed a Call for the Commitment process. 20 applicants received project writing training in this respect and eight of these applicants were awarded with national infrastructure commitment letters. 16 proposals in this call included partners from Turkey and nine of them received above-threshold scores as a result of the evaluation.

A second national initiative has been launched by TÜBİTAK with the aim to increase awareness about ESFRI opportunities among the national RI managers and the first workshop was held in 2018 addressing the research centres operating under the TÜBİTAK umbrella. The map of the interested RIs and their correspondence with the ongoing ESFRI projects is being prepared. Further meetings, workshops and initiatives will be put in to practice for increased alignment, awareness and interest with regards to ESFRI projects.

Objective 2b.5: Providing sustainable data management for research

Growing research activities, including transnational and international collaboration, produce large amounts of highly valuable data which can be used for future research as a foundation/base or an additional data source. This data needs to be stored for a long term and be made available to researchers.

Currently, these secondary level data warehouses are provided by TRUBA under TÜBİTAK-ULAKBİM with the support of the Office of Strategy and Budget under the Presidency. With the increased amount of data produced due to increased research size and capacity, at least one other suitable RI will be supported to provide secondary data warehouse services.

ERA Priority 3: An Open Labour Market for Researchers

Researcher development, open recruitment and increased mobility are key to catalyse interactions to boost excellent research base. Increased investments through varied programmes are offered by TÜBİTAK to establish a vibrant environment for researcher career development and mobility in Turkey. Joint actions among TÜBİTAK, Council of Higher Education of Turkey (YÖK), Universities, and research performing organizations are needed to promote uptake and better implementation of researcher career development, mobility and recruitment processes.

Within “Attracting Qualified Human Resources Programme” of the Tenth Development Plan TÜBİTAK coordinated the “Qualified Human Resources Centre of Attraction Program and Action Plan.” Such a program is formed with the vision of transforming Turkey into a hub of qualified human resources. The Plan also included action items on establishing opportunities to attract researchers from the Turkish diaspora, which has been supported based on awareness building “Target Turkey” workshops in several international destinations around the world.

The main components of becoming a “Centre of Attraction” are built upon priorities for awareness, organization and network development, improvement of work and living environments, and the establishment of relevant support programmes. The key

performance indicators include those of researchers that undertake education, internships, and work positions abroad, the number of in-bound researchers, the number of international graduates that receive a work permit in Turkey, the number of international researchers that receive funding from TÜBİTAK support programs, citizens that have benefited from mobility programs, and scientists that have received support under TÜBİTAK fellowship programs. Turkey aims to increasingly capture opportunities for realising “brain gain” to become a “Centre of Attraction.”

Increasing openness, transparency and a merit-based approach in the recruitment process is a key factor in complementing the actions being taken towards increasing researcher base in enabling both TARAL and ERA to reach their full potentials. In order to achieve this aim, TÜBİTAK has become a participant in the EURAXESS initiative of the European Commission as a Bridgehead Organization (BHO), representing Turkey in this initiative. Consequently, it has established a connection between TARAL and ERA in order to facilitate building an open and transparent labour market of researchers by providing free, timely and high-quality support to facilitate the relocation and career development of researchers in Europe. EURAXESS offers various tools and strategies to achieve these aims, which TÜBİTAK promotes and practices them as a BHO. In 2005, the European Commission adopted a “European Charter for Researchers and a Code of Conduct for the Recruitment of Researchers” (Charter and Code) which consists of a set of general principles and requirements that should be followed by employers and/or funders when appointing or recruiting researchers. Izmir Institute of Technology (IZTECH) endorsed the 40 principles of Charter & Code in 2012. Currently, two Universities from Turkey (Middle East Technical University and Koç University) informed the European Commission about the endorsement of the 40 principles of the “European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers” in October 2018. These two Universities committed to complete the first step of the HRS4R within the next 12 months. By implementing the 'Charter and Code' principles, they joined a community of European universities, institutions and funders, including a number of international institutions, which are committed to continuously improve their HR practices. Implementing these principles will help to ensure the availability of motivated, highly qualified and skilled human resources in research and innovation.

Following the best practices of these two Universities, TÜBİTAK will continue to motivate the other Universities and research centres to endorse “European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers”.

EURAXESS promotes the implementation of Charter & Code with the “HR Strategy for Researchers” (HRS4R) and supports research institutions and funding organizations in the implementation of the Charter & Code in their policies and practices. It is important for TÜBİTAK to promote participation in the HRS4R and the uptake of the Charter and Code by research performing organizations as it facilitates the reviewing of their recruitment policy and practices. The European Commission recognizes institutions that make progress in aligning their human resources policies with the 40 principles included in the Charter and Code, by awarding them with the ‘HR Excellence in Research Award’, based on a customized action plan/HR strategy. Obtaining this award for Turkish institutions is another of TÜBİTAK’s aims.

Objective 3.1: Increasing attractiveness of TARAL for top research skills

In order to attract leading researchers to conduct their research activities in TARAL, TÜBİTAK launched "The International Fellowship for Outstanding Researchers".

This Fellowship provides support to encourage qualified researchers with leading scientific and/or technological achievements and international working experience to conduct their research in leading academic, industrial or public institutions in Turkey towards contributing to projects in research areas that are of strategic value. The fellowship includes a scholarship for the researcher, research grants, a scholarship for establishing a research team, a project incentive bonus, a host institution overhead, and social benefits for the researcher and their family.

It is expected that the research fellow is a part of the "Highly Cited Researchers" list published by Clarivate Analytics in the year prior to the date of application, has conducted his/her research in one of the top 100 universities according to the QS (Quacquarelli Symonds) World University Ranking or has conducted research in one of the top 2500 companies with the highest R&D expenditures according to the "Industrial R&D Investment Scoreboard" as published by the European Commission Joint Research Centre.

The International Fellowship for Outstanding Researchers aims to attract high quality human resources for science and technology to conduct and engage in the research ecosystem of Turkey. The target audience of this leading fellowship opportunity is both young and experienced researchers. The target audience includes both Turkish nationals and international researchers with leading research career experience and contributions.

Moreover, TÜBİTAK has introduced a new Horizon 2020 Marie Skłodowska-Curie Actions Cofund program "Co-Funded Brain Circulation2 Scheme (CoCirculation2)", following its prior CoCirculation, which was a successful FP7 project and to which TÜBİTAK re-applied for the 2nd term. CoCirculation2 is a 5-year project aiming to invite experienced researchers to both academic and non-academic research performing organizations located within Turkey. Within this context, 100 experienced researchers of any nationality who wish to engage in incoming mobility and to implement a research project in Turkey will be able to apply for a fellowship. 4 calls for proposals will be published.

The objective of CoCirculation2 is to diversify experienced researchers' individual competence through advanced training, international and inter-sectoral mobility opportunities through incoming mobility into Turkey. The triple 'i' dimension is applied to the program, with the objective to strengthen the effect of the fellowship on the researchers' careers. All fellowships must have an international component, and inter-sectoral and interdisciplinary elements in each project are highly encouraged.

The above mentioned fellowship and project will be utilized for researcher career development and mobility, thus increasing attractiveness of TARAL. Research universities will be further encouraged and supported to create favourable conditions for researcher career development, international and inter-sectoral mobility opportunities.

Furthermore, “Frontier Research Support Programme” is under preparation to support cultivation of high added value research outputs including social sciences. This Programme also aims to contribute to Turkey’s ERC success through complementary actions. It will be designed to enhance frontier research capacity of Turkish researchers and increase their competitiveness in ERC.

Objective 3.2: Increasing University-Industry Cooperation for qualified human resources

TÜBİTAK launched “Industry PhD Programme” to contribute training of qualified human resources holding a PhD degree for the needs of industry. The provision of an inclusive capacity to the private sector to improve their technological competences and level of technological diversification further depends on the access of the private sector to high-quality human resources. With this newly designed scholarship program that is launched in July 2018, higher education institutes, certified research laboratories and private sector firms can make a joint application with involvement from private sector R&Ds and product design centres as well as start-up firms in techno parks. The program would provide four-year scholarships to students for PhD studies and support for employment after graduation. In total, 500 industrial doctoral program students will be supported.

Objective 3.3: Research Performing Organizations will be motivated for uptake of Charter and Code and participation in HRS4R

TÜBİTAK will continue to motivate Universities and research centres to endorse “European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers”. A Conference on Charter and Code will be organized in the second half of 2019 to increase awareness and motivation of Universities in Turkey.

Universities and research organizations will be motivated for and expected to use open, transparent and merit based recruitment practices with regard to research positions and to review current recruitment processes and amend them where necessary to improve openness and transparency for an effective research environment.

Objective 3.4: Promotion of and increased participation in EURAXESS

EURAXESS is a platform for researchers, entrepreneurs, universities and businesses to interact with each other. It is a joint initiative of the European Commission with the 40 countries participating in the European Union's Horizon 2020 Programme for Research. EURAXESS supports researcher mobility and career development, while enhancing scientific collaboration between Europe and Turkey. Enhanced use of the EURAXESS Portal is among the objectives of TÜBİTAK included in the ERA Roadmap.

- EURAXESS Portal: Revamped EURAXESS Turkey National Portal has been created in 2017 (https://www.euraxess.org.tr/). Via this portal, open and transparent research jobs/funding positions started to be publicized in all European Research Area. It is aimed to increase the number of research jobs/funding positions from TRA on EURAXESS Portal in order to create an open market for researchers. Universities and

research organizations will be further encouraged to advertise all vacancies on the EURAXESS Jobs Portal.

- EURAXESS Service Centres: The Service Centres, which are local hubs for EURAXESS Services, help researchers and their family to plan and organize their move to and from Turkey, and assist with all matters related to mobility. Researchers can use Service Centres to get practical information concerning professional and daily life, as well as information on research jobs and funding opportunities. As of 2019, there are two Service Centres in Turkey, and they are located in Middle East Technical University and Izmir Institute of Technology (IZTECH). TÜBİTAK aims to increase the number of service centres and make EURAXESS easier to reach across Turkey.
- Science4Refugees: EURAXESS is also gateway to Science4Refugees, a Commission's initiative helping refugee researchers find suitable jobs in today's challenging research landscape. Part of the initiative, is the Science4Refugees Research Buddies, supporting refugee scientists in finding European researchers to discuss problems, find solutions and study together, by matching their research field, scientific studies and interests. TÜBİTAK supports Science4Refugees initiative and promotes it through different platforms.

ERA Priority 4: Gender equality and gender mainstreaming in research

Producing high quality research, attracting and retaining best skills and supporting gender equality are important for a well-established research base. Gender equality in ERA is based on fair, open and transparent recruitment and promotion processes identified through the European Charter and Code and the ERA roadmap principles. In addition, integrating gender into research and innovation activities needs to be supported through the dedicated actions of governments and institutions.

Careers in research demand rewarding of the best skills and talents. This task can be successfully accomplished only if the designation of researcher careers is undertaken on a merit based approach in which women have a high and equal standing. Knowledge societies can be attained only if the whole of society, including the distinguished role of women, are fully integrated into the most demanding tasks, in particular research careers, in an inclusive manner.

According to Women in Science database of European Commission (2016), the ratio of women among academic staff is 41.3% in EU, while it is 42.8% in Turkey. In order to maintain women's high participation in research and research careers, dedicated actions will be encouraged.

Objective: Preparing Gender Equality in Research Plans at National and Institutional Levels

Even though the ratio of women academicians in Turkey is above the EU average, equal participation into all disciplines, advancement of women research careers and incorporation of gender issues in research and innovation will be further supported. A gender based research skills development approach will be incorporated into the institutional researcher

development plans. Currently, the “National Gender Equality Plan in Research” is being developed with a focus on research and innovation. The gender equality plans for universities and research institutions will increase the availability of equal opportunities for women. Equality plans should go beyond gender dimension and encourage the involvement of disabled people in research.

The National Gender Equality Plan in Research will be based on compiling and processing gender statistics, boosting leadership of women in research careers and skills development in Science, Technology, Engineering and Mathematics (STEM) for women.

RFOs and RPOs will be encouraged to take joint actions to compile and process gender-related statistics for evidence based monitoring of gender in research and innovation. In order to integrate gender into research and innovation activities, advancement in data collection is crucial. The gender plans in research will include priorities/steps related to both the data collection process and the dissemination and application of results. What is more, as EU’s definition of gender dimension in research goes beyond just a balance in female and male researchers, bringing a gender perspective in research contents and outputs by including how research questions are posed, research is executed, and results are interpreted and exploited, would be one of the objectives to be considered during the development of both national and institutional level Gender Equality Plans in Research.

Increasing equal opportunities for leadership in academia would be one of the objectives to be considered by national and institutional level gender equality plans. In order to increase the number of women in decision-making bodies, specific actions could be considered.

Specific targets including timelines and time-bound strategies, monitoring system for the planned actions and national repositories of institutional gender equality plans could be an integral part of gender mainstreaming in universities. Introduction of guiding targets for decision making bodies such as leading administrative boards, and promotion and evaluation committees that secure equal representation and involvement could facilitate the implementation of gender equality plans.

Turkey’s strength is women’s active participation in STEM fields in research and innovation. Still, ongoing projects and policy practices support statistically increasing the number of women participation into those fields. Especially, women entrepreneurship and innovators are well encouraged within training and support programs. In order to raise awareness and increase the number of women in STEM fields, tailor made actions for equal employment and encouraging gender criteria in activities of RPOs and RFOs will be considered.

Ministry of Family, Labour and Social Services developed an extensive Strategy and Action Plan for Empowering Women (2018-2023). This Strategy and Action Plan aims to compile already conducted scientific research on women health and initiate further scientific research in this field. Women employment in information and communication sector will be strengthened. This Strategy and Action Plan entails a wide collaboration scope with related ministries, NGOs, universities, municipalities, regional governments, private sector, for related policy domains.

Era Priority 5 – Optimal Circulation and Transfer of Scientific Knowledge

5a: Fully implementing knowledge transfer policies at national level in order to maximize the exploitation of scientific results.

At national level a strong legal basis is established in Turkey towards knowledge transfer. Upon this basis TÜBİTAK carries out management of IP Rights (IPR) and commercialization activities. Increased capacity for IPR management and knowledge transfer is planned for the success of TARAL.

The Industrial Property Law (Law No.6769) and the Law on Intellectual and Artistic Works (Law No. 5846) are the main regulations on intellectual property rights in Turkey.

The main fields that IP law regulates are industrial property and copyrights. Until the enactment of Law No. 6769 in January 2017, industrial property rights were protected under Trademark Decree No. 556, Patent Decree No. 551, Industrial Design Decree No. 554 and Geographical Indications Decree No. 555. Due to the legal nature of Decrees, certain key provisions had been cancelled by the Constitutional Court of the Republic of Turkey. The annulment of these provisions, as well as economic developments and the 7th Chapter of the European Union Acquis required a revision of the Turkish intellectual property law.

Law No. 6769 entered into force on 10th January 2017 and as such, the above mentioned decrees were gathered under one law consisting of five chapters and 193 articles. It is important to note that Turkey is a signatory to the Paris Convention, the Hague Agreement, Madrid Protocol, Patent Cooperation Treaty (PCT), Rome Convention, UPOV Convention, Berne Convention, TRIPS Agreement and a member of the World Trade Organization (WTO). Law No. 6769 and Turkey being a party to the international agreements, helped harmonize Turkish IP law with the European system. Moreover, Turkey continues its close collaboration with World Intellectual Property Organization (WIPO) and European Patent Office (PTO) to increase IP awareness in Turkey.

Copyrights, the other main branch of intellectual property law, are protected under the Law on Intellectual and Artistic Works (Law No. 5846). Specialization Commission meetings have been commencing for the amendment of the Law No. 5846.

Chapter 7 of the European Commission Report dated 17th April 2018 examining the state of intellectual property law in Turkey, declares that "Turkey has a good level of preparation in the area."; whereas in its previous Report released in 2016, the Commission had stated that "there was some progress in improving administrative capacity and coordination but enforcement remained problematic."

The 2018 Progress Report also states that the adoption and entry into force of the new Industrial Property Law is a significant part of the good progress. The Commission deems the adoption of Law No. 6769 as one of the most valuable and noteworthy developments regarding intellectual property law in Turkey.

In order to manage the Intellectual Property arising from TÜBİTAK support programs, its institutes and R&D centres, as well as all other departments under the roof of TÜBİTAK. TÜBİTAK enacted *the* Regulation regarding Management of Intellectual Property Rights and Technology Transfer in April 2016. As such, all activities concerning the commercialization of

TÜBİTAK's IP rights have now become within the framework of the duties of TÜBİTAK Technology Transfer Office (TÜBİTAK TTO).

As a directorate functioning under a public agency, TÜBİTAK TTO has also been serving to contribute to the professionalization of intellectual property management within and outside of TÜBİTAK, by way of issuing legal opinions on the implementation of Law No. 5846 and Law No. 6769 and their supporting regulations, as well as interpreting institutional rules and regulations in Turkey.

Objective 5a: Advancing Knowledge Transfer and IPR Management

Support Scheme for Management of IPR and Technology Transfer in Turkey "1513 – TÜBİTAK Technology Transfer Office Support Program" has a renewed structure for encouraged learning and experience sharing on technology transfer.

TÜBİTAK launched its Technology Transfer Office Support Program, which aims to raise the academic research capacity in universities and encourage technology transfer activities to increase the university-industry collaborations, IP management, licensing, commercialization and establishment of spin-off / start-up companies.

As of 2018, almost half of Turkey's 205 higher education institutions claim to have some form of technology transfer office. 25 of these technology transfer offices are supported under the 1513 Program. Moreover, 18 TTO's are supported under a different capacity building program.

A distinctive feature of the 1513 Program is its incorporation of preliminary modules before licensing and commercialization activities. These three modules are; (i) awareness, advertising, informing and education oriented activities for both the academic and the industrial environment, (ii) operations to benefit from funding and national/international support programs, and (iii) university-industry collaboration. Each of the three modules have their different set of functions, tasks and performance indicators. TTOs need a continuous accumulation of new knowledge and generation of IPs to commercialize. These preliminary modules are aimed to foster knowledge accumulation and also the culture that encourages these activities. Although some TTOs that are in other countries are conducting these extra activities, TÜBİTAK's policy in the TTO programme makes the Turkish TTO model significantly different compared to its counterparts in the world.

Law No. 6769, which was enacted at the end of 2016 brought important changes to Turkey's IPR regime. Before this law, academic staff had the privilege of keeping the ownership of their inventions; whereas the new law allows higher education institutions to claim rights on such inventions. Another legislation, Law No. 7033, enabled universities to establish TTO companies to commercialize their research output and IPR portfolio.

In this context, TÜBİTAK adopted a target and performance based approach, and renovated the 1513 Technology Transfer Office Support Program in 2018. In this new scheme, the amount of support TTO's may receive is related to their performance indicators, which are annually set depending on university characteristics. The Programme's new setting aims to encourage collective learning and experience sharing among TTO's by continuously identifying growth areas and best practices in technology transfer activities.

Moreover, TÜBİTAK TTO will continue to assist the management, protection and commercialization of IP rights by organizing trainings on technology transfer mechanisms, IP management, patent application and related processes at a national level.

5b: Open access to publications and data in an open science context

Open Access and Open Science constitute basis for increased visibility, increased citations, equal access (including disabled people), wider dissemination of scientific knowledge and research results. The impact of open access is favourable in terms of capturing value out of research and achieving increased returns to public investment in research.

Council of Higher Education (YÖK) together with TÜBİTAK are leading the processes for enabling open access at national scale. The national level strategies and actions would be complemented by university level activities for open access.

Objective 5b: Promoting and implementing an Open Science and Open Access approach

YÖK formed a Commission on Open Access including the rectors, related faculty members, TÜBİTAK representatives and library documentation experts. In this context, YÖK highlighted the importance of establishment of the "Open Academic Archive System" in the international standards in all universities, the integration of the university archives into "Open Access" (OpenAIRE)" through Harman (national installation of OpenAIRE software), and using of "Universal Researcher Numbers (ORC-ID)".

Concrete steps are declared by YÖK as of January 2019:

- Reporting of the work carried out by universities and the number of publications in open academic archives in a method and format determined by YÖK in six-month periods,
- Establishing a commission under the chairmanship of the rector / vice-rector responsible for open access and open science studies at universities and organizing awareness meetings to develop a clear ecosystem within the university,
- Revision of the Academic Incentive Regulation in order to promote publishing in open access journals and production of open education material,
- Ensuring the participation of the relevant staff of the universities in the meetings and trainings organized by YÖK.

In 2019, TÜBİTAK will take decisive actions towards Open Access and Open Science in cooperation with YÖK:

- Adoption of TÜBİTAK's Open Science Policy (effective as of 14 March 2019)
- Adoption of the timeline: 2019 as a pilot year for selected support programmes, and 2020 as the year of transition to mandatory policy implementations in Open Access for all support programmes
- Launching pilot call with Open Science requirements in the second half of 2019
- Setting up of the aperta.ulakbim.gov.tr (Institutional Repository for TUBITAK and Research Data Management to serve all universities) as a live system (live)

- Opening of the open data portal: acikveri.ulakbim.gov.tr (Launched in February 2019)
- The dissemination of Turkey Academic Archive (Harman) (Harvester to harvest all university IRs, based on OpenAIRE harvester, live)

ULAKBİM has assembled the TÜBİTAK ULAKBİM National Open Science Committee. This Committee is composed of academicians in the area of open access studies, experts from Information and Library services of the institutions and experts from related units from TÜBİTAK. The Committee decides on national open access/open science strategies.

In accordance with the Committee's decisions, an Open Access policy and mandate is under discussion for TÜBİTAK as a funding agency and will be implemented in 2019. TÜBİTAK is planning to launch an Open Science pilot call in 2019. In order to have the necessary infrastructure for Open Science, TÜBİTAK ULAKBİM has set up a research data repository called Aperta, based on Zenodo and Invenio, which aims to build an open-source turnkey research data management (RDM) platform. After the implementation of TÜBİTAK Open Access Policy, it is expected that all peer-reviewed publications from projects funded by TÜBİTAK will be Open Access, preferably through Aperta. Aperta is planned to be the main research data management platform nationwide and any researcher who would like to share their peer-reviewed publication or data from their publication would be able to use this platform. The end goal will be the publication of all publicly funded research articles on an open access basis in the future.

Similarly, in order to increase the dissemination, longevity and reusability of the data used and obtained in publicly funded projects, the projects will have their data management (DMP) and data access (DAP) policies included. Projects will open their data accordingly unless ethical or secrecy reasons are present. The DAP and DMP provided by the projects will govern the access to the data by the researchers and/or institutions. These policies will also enable long term storage and availability of the aforementioned data under a RDM like Aperta or a dedicated, specialized portal if the data requires and benefits from such specialized access mechanisms.

There are ongoing efforts to establish a national open science strategy. Although its publication and implementation is planned to be a longer term objective, dedicated actions are put in place towards this aim. National Open Access Workshops are held yearly under the coordination of ANKOS (University Librarians Consortium) and TÜBİTAK ULAKBİM in order to coordinate Open Access strategies nationally, monitor recent developments in open access and determine the actions required for an open science policy in Turkey. Representatives of the EU, the Turkish Council of Higher Education (YÖK), the Turkish Scientific and Technological Research Council (TÜBİTAK), university rectors, high-level representatives of industrial organizations and NGOs are attending these workshops yearly. It is of utmost importance that all the stakeholders provide support and develop their own open science strategies aligning with the national open science strategy and the EU legislation.

Continuous efforts on raising awareness on Open Access in Turkey have led to many institutional archives, especially in universities. The "Harman" (http://arsiv.ulakbim.gov.tr/index) is the first and currently only OAI harvester in Turkey. It is built to enable widespread access from a single centre to scientific contents limited and

suitable for open access, and provide easy and safe access to national and international contents. Currently there are 71 institutions and 584,899 records in the archive.

Other important aspects are to raise awareness among stakeholders about open science and relevant strategies, and to inform researchers about research data management and data sharing governance. TÜBİTAK is undertaking a main role in the dissemination of open science information to all stakeholders. As an example, documents for information on research data management for every stage of a research project is provided on the ULAKBİM Research Data Management portal (http://acikveri.ulakbim.gov.tr/). These efforts will be maintained and increased. Especially following the adoption of TÜBİTAK Open Science Policy, TÜBİTAK aims to provide training to the researchers for the data management plan and to establish units that can help the researchers who want to store and share the research data. In accordance, Universities should promote open access and open science awareness among their researchers.

In this vein, TÜBİTAK acknowledges the importance of Plan-S and cOAlition S principles and takes decisive steps firstly towards green open access and open science strategies. As Open Access adoption spreads in Turkey, and as the Open Access trail that is being blazed by cOAlition S expands, TÜBİTAK will take necessary steps for alignment. TÜBİTAK is willing to increase cooperation and coordination with European Commission towards open science and open access implementation process in Turkey.

ERA Priority 6: International Cooperation

Growing internationalization of science and technology necessitates national research systems to further invest in a stronger knowledge base and take benefit of the internationally produced knowledge for gaining and maintaining competitive power. ERA prioritizes international cooperation and calls for developing and implementing appropriate joint strategic approaches and actions for international STI cooperation on the basis of national priorities. Towards this aim, Turkey recently launched a strategic approach in order to increase the impact of international scientific and technological cooperations as follows.

Targeted R&D Collaborations with Global Leaders	International R&D collaborations • with leading countries • in emerging technologies in focus sectors (High budget, high impact)
Demand-driven R&D cooperation	• Addressing global/regional challenges jointly • Internatinal cooperation to meet Industry's R&D needs
Strategic R&D Partnerships with Development Focus	• Development-oriented cooperation and technology transfer with developing and underdeveloped countries
Diplomacy-Oriented R&D Cooperations	• The use of R&D as a tool and communication with the countries where the cooperation is strategically perceived within the scope of foreign policy objectives

Output oriented formulation and implementation of bilateral calls has been launched. Bilateral calls will be designed and implemented in order to produce solutions to industrial R&D needs. Moreover, the number of internationally co-authored publications produced out of bilateral cooperation projects will be fostered and scrutinized. This is expected to increase the number and quality of internationally produced publications from Turkey (both ERA and non-ERA partnerships). The rate of internationally produced publications is growing. According to the UNESCO Science Report, towards 2030, the share of publications with international co-authors will be 45.5% in EU, whereas this level was 21.6% for Turkey by 2014. Since 2008, the growth rates of EU and Turkey were 20% and 30% respectively. This improvement will be further supported via tailor made bilateral calls and increased engagement of Turkey to EU Framework Programmes.

TÜBİTAK carries out and monitors the activities of bilateral, multilateral and regional research coordination and cooperation worldwide. There are 63 bilateral cooperation agreements with 51 countries at the intergovernmental or inter-institutional levels. Within the framework of these agreements, joint research and innovation projects are supported and monitored including financial support for different types of activities such as scientific meetings, exchange of scientists, scientific visits, etc.

Additionally, Turkey is actively participating in the activities of a variety of European research programmes and international organizations such as European Cooperation in the field of Scientific and Technical Research (COST), International Centre For Genetic Engineering And Biotechnology (ICGEB), The Asia-Pacific Space Cooperation Organization (APSCO) and European Molecular Biology Conference (EMBC); regional organizations such as Black Sea Economic Cooperation (BSEC) and Economic Cooperation Organization (ECO), Alliance of International Science Organizations (ANSO) and NATO, OECD and UNESCO as well. Participation of Turkish scientists in the events organized by these organizations are supported and monitored by TÜBİTAK.

Turkey's motivation for increased involvement in bilateral and multilateral research and innovation programmes is based on two major aspects: Creating a favourable international cooperation culture, and increasing Turkey's existence as a strong international research and innovation partner.

Objective 6.1: Improving the effectiveness of bilateral and multilateral cooperation programmes and tools

TÜBİTAK aims to improve the effectiveness of bilateral and multilateral cooperation programmes and tools. Application and evaluation processes of international collaboration programmes has been updated with a more integrated perspective. While, Joint online applications and joint evaluations have been put in practice for selected bilateral calls. This allowed funding partners of the bilateral calls to receive a higher number of applications with better quality. This method will improve the effectiveness of processes, save time and resources for both funding institutions and the researchers.

Furthermore, new flexible funding programmes have been launched. One of the most promising programmes in this regard is the newly launched TÜBİTAK 1071 Programme aiming to enable targeted international cooperation and establishing strategic R&D partnerships. The 1071 Programme is expected to make a leverage effect for the bilateral calls. This programme enables funding of larger, inter-sectoral and target oriented joint projects with countries of strategic importance.

Objective 6.2: Maintaining strategic international and regional partnerships

Turkey's active membership in regional and international science and technology organizations allows for the improvement of the research culture in Turkey. Turkey is a member of regional organizations such as the Black Sea Economic Cooperation (BSEC) and Developing-8 (D8), international organizations such as APSCO, EMBO, ICGEB, COST and takes leading roles in initiatives such as the UN Technology Bank for Least developed Countries (LDCs).

Turkey carries out the secretariat of D8 and BSEC aiming to create new mechanisms of collaboration to promote the sustainable development of member countries of these organizations. Also, Turkey is the host country of the UN Technology Bank for LDCs that was established to improve the science and technology of the LDCs. Turkey has been involved in the establishment process of the Bank since the very beginning and it is still taking concrete steps for the initiative and has produced effective results. The UN Technology Bank for LDCs is also considered as a stakeholder to make a STI cooperation with underdeveloped countries. Moreover, Turkey engages in several other partnerships, such as the Partnership for Research and Innovation in the Mediterranean Area (PRIMA), Blue Growth Strategy and Belmont Forum and acts responsibly towards addressing challenges concerning food systems, water resources, and ocean sustainability. Being a partner to the BLUEMED Initiative, TÜBİTAK contributes to the Strategic Research and Innovation Agenda (SRIA) of Initiative aiming to boost blue jobs and blue growth in the Mediterranean. Also, Turkey's regional cooperation is sustained through Union for the Mediterranean (UFM) via Ministry of Foreign Affairs.

TÜBİTAK is involved in the platforms that promote third country/region participation and develop multilateral cooperation with Japan, Russia, Latin America and Southeast Asia through platforms such as European Interest Group (EIG) Concert-Japan, The European Union – Latin America and Caribbean Interest Group (EU-CELAC), The Southeast Asia-Europe Joint Funding Scheme for Research and Innovation (JFS), ERA-Net RUS Plus.

Furthermore, as a founding partner, Turkey is actively participating in all instruments of EUREKA. As an intergovernmental network, EUREKA aims to enhance European competitiveness by fostering innovation-driven entrepreneurship in Europe, between small and large industry, research institutes and universities. It remains to this day the only initiative of its kind committed to the 'bottom-up' principle - ensuring that any R&D project with a good business plan receives the support it deserves, independent of its technological nature, or the type of organisations involved. As being one of the most important instruments of EUREKA, Eurostars is the Article 185 initiative which is carried out by EUREKA secretariat in cooperation with the European Commission. EUREKA, together with its instruments is a leading open platform for international cooperation in innovation. Turkey is

an active participant of EUREKA by promoting these programmes nationally among the national innovation actors and by using national funds to support the international innovation projects of SMEs and large companies.

Increasing internationalization of innovation actors in Turkey is of key importance in order to boost innovation capacity of Turkey. International STI cooperation proposes bottom-up and collaborative solutions for the national research systems to cope with the challenges posed by increased R&D competition. Moreover, through international scientific cooperation, researchers can find grounds to cooperate for local technological, economic and social challenges. In this respect, partnerships to international networks and organisations will be further promoted.

Universities have a key role in enhancing international cooperation as they provide the basis for open science and innovation through open access and open date strategies and infrastructure. They need to encourage mobility of researchers and students, reward international cooperation success, adopt institutional strategies for enhancing international cooperation and contribute to national and international policy.

Research cooperation paves the way for prospective innovation and learning networks beyond national research systems. The contribution of bilateral and multilateral networks including EU Framework Programmes is critical to establish research and innovation linkages for global and local challenges. In this respect decisive active participation of Turkey in programmes will be maintained in the future in order to help access resources, skills, knowledge and infrastructure needed to jointly tackle global challenges. International cooperation networks will be promoted via dedicated info-days, trainings and meetings.

Conclusion and Next Steps

Measures towards restructuring and reforming Turkish national research and innovation landscape found a significant role in governmental efforts. A vital part of this new reformist vision aims to empower national authorities, universities, researchers and innovators towards developing a stronger research and innovation base in Turkey. Alignment towards ERA priorities via increased participation in EU Framework Programmes finds a core role in novel policies and approaches introduced by government. Bottom-up engagement of universities to the ERA alignment process is the key for success. Increased financial resources, diversified support schemes, enhanced possibilities for mobility introduced by TÜBİTAK provide favourable conditions for internationalization. Opportunities ahead needs to be fully exploited by Turkish academia. Decisive institutional strategies would help to embrace ERA priorities and complement national actions towards this aim.

Building a vibrant research culture at national and institutional levels needs strong ownership and increased partnership especially with ERA stakeholders. Participation in EU Framework programmes (Horizon 2020) helps increasing visibility in European landscape and building critical linkages among Turkish and European counterparts. Revised institutional structures backed up by decisive reforms helps to build a strong research and innovation base in Turkey. Joint efforts of Turkey and the EU are needed to build and reinforce ERA. Thus, building joint actions with European Commission towards increased participation of Turkey in Horizon 2020 is of crucial importance.

This National Roadmap aims to set the ground for common efforts towards a stronger ERA via increased alignment of TARAL. In this respect, each and every ERA Priority will be dealt in detail, objectives will be enriched and actions will be diversified. Active participation and ownership of universities, national authorities and research organizations are called to jointly build on ERA Priorities. From 2019 onwards, joint workshops, advisory groups meetings and studies will be encouraged to facilitate alignment towards ERA Priorities in close cooperation with the European Commission.

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