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Executive Summary

Turkey has a dynamic economy which ranks 17th in the 2010 list of world economies (IMF, 2011)¹. The country has a population of 73.7m (TURKSTAT, 2011), accounting for 14.7% of the population of the EU-27 (EUROSTAT, 2011). 67% of the population are between 15-64 years of age and half is younger than 29. While the annual average growth rate was 1.8% between 2008 and 2010 in real terms, Turkey achieved a GDP growth of 9% in 2010. The GDP in 2010 was €554,829m (TL1,103,750 m) and realised €412,214m (TL957,326m) in the first three quarters of 2011(TURKSTAT, 2011).²

Turkey continues to increase its research and development (R&D) investments since the turn of the century. The R&D intensity in Turkey was 0.84% in 2010 (TURKSTAT, 2011). While it is below the EU-27 average of 2% (EUROSTAT, 2011), the gross expenditure on R&D increased by 28% between 2008 and 2010 in real terms.³ Between the years 2008-2010, the Business Expenditure on Research and Development (BERD) undertaken in Turkey increased by 24% in real terms. There was 23% increase in Government Expenditure on R&D and 34% increase in the Higher Education R&D (HERD) in real terms between the years 2005-2009. The amounts allocated to R&D in the state budget have not been cut but increased during the global financial crisis: funds allocated in 2008, 2009 and 2010 were €702.14m (TL 1,331.10m), €881.39m (TL1,895.45m) and €905.32m (TL1,801m), respectively. In 2011 they reached, €773.73m (TL 1,796.92) (BTYK23, 2011).

The main changes in the research and innovation system in 2011 were the reorganisation of three key ministries: The Ministry of Science, Industry and Technology (MoSIT) replaced the former Ministry of Industry and Trade after the elections in June 2011. The science, technology and innovation-related duties of the MoSIT are defined as the development, implementation and coordination of the S&T and innovation policies, and the promotion of the R&D and innovation projects, activities and investments. The Ministry of Development (MoD) replaced the former State Planning Organisation and is responsible for providing advice to the government and preparing national plans, policies, strategies and programmes, and coordinating regional development agencies, among other things. The newly created Ministry of Economy (MoE) is responsible for developing and implementing of foreign trade and foreign direct investment policies, and investment incentives, among others. These ministries along with the other high-level bodies in the national innovation system are represented in the Supreme Council of Science and Technology (BTYK), which is responsible for the overall coordination of the national innovation policy.

New national R&D targets of Turkey for 2023 were agreed by the BTYK on 27 December 2011. These are as follows:

- Achieving an R&D intensity of 3% (from 0.84% in 2010)

¹ <http://www.imf.org/>

² €1=TL2.32 <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=8651>

³ Expressed in 2011 constant prices
http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/istatistikler/BTY05.pdf

- Increasing business R&D expenditure as a percentage of GDP to 2% (from 0.36% in 2010)
- Increasing the number of FTE researchers to 300,000 (from 64,341 in 2010)
- Increasing the number of FTE researchers in the private sector to 180,000 (from 25,342 in 2010).

The National Science, Technology and Innovation Strategy 2011-2016 adopted in December 2010 by the BTYK focuses on human resources development for science, technology and innovation, transformation of research outputs into products and services, enhancing interdisciplinary research, highlighting the role of SMEs, R&D infrastructures and international cooperation. It also identifies automotive, machinery and production technologies, ICT, energy, water, food, security and space as focus areas. In line with this, the strategy puts special emphasis on keeping the balance between focused areas and bottom-up research (TUBITAK, 2010 and IUC, 2011).

In addition to the National Science, Technology and Innovation Strategy 2011-2016, at the BTYK meeting in December 2011, the following new items were identified for the improvement of the research and innovation performance of the country:⁴

- Setting up a coordination board to secure integration, coherence and target-oriented approach in R&D, innovation and entrepreneurship support mechanisms;
- Developing policy tools to activate and increase the number of R&D intensive start-ups;
- Developing policy tools to trigger innovation and entrepreneurship in universities;
- Promoting entrepreneurship culture;
- Improving public procurement and public right of use in such a way to foster innovation, localisation and technology transfer;
- Promoting science centres;
- Developing policy tools to stimulate domestic patent licensing.

Based on the key indicators and issues, the following challenges are identified for Turkey:

1. Promoting research commercialisation from universities: This can take place in various forms, such as university start-ups and spin-off, mobility of researchers and students, contract research projects, joint research projects, innovative public procurement (as both buyers and suppliers), licensing, consulting, trainings, formal and informal networks, competitiveness clusters, etc. The above-listed new decisions of the BTYK and the National Science, Technology and Innovation Strategy 2011-2016 focus on this challenge. The enrichment of the policy mix with a variety of measures (financial, non-financial, etc) will help address this challenge.

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<http://www.tubitak.gov.tr/sid/0/pid/0/cid/26210/index.htm;jsessionid=99F0D41EDD150485B88A89300B4B0C62>

2. Increasing the number of innovative high-growth start-ups: the underdeveloped venture capital and business angels market, as well as limited number and variety of policy measures for start-up creation is an important barrier. The BTYK decisions of December 2011 recognise this challenge and aim to address through policy measures to be developed. The new 'Entrepreneurship Council', which was created in January 2012 by the MoSIT and other key stakeholders, is also expected to play a key role in the development of the business angel and venture capital market. A full range of measures is needed to address this challenge.
3. Increasing R&D and innovation capabilities of the private sector (in particular, micro, small and medium enterprises (MSMEs)): The low levels of absorptive capacity of the business sector particularly that of MSMEs is a barrier to increase R&D and innovation performance. Micro enterprises dominate the enterprise sector (93.8% of firms in manufacturing industry and 99.1% of those in services sector are enterprises with less than 10 employees) (OECD 2010). The National Science, Technology and Innovation Strategy 2011-2016 highlights the role of SMEs. It is important to design and implement specific measures for enhancing the learning capabilities, absorptive capacity, and R&D and innovation capabilities of MSMEs.
4. Focusing on sectors and thematic areas of importance: It is important for Turkey to focus on priority sectors, technology areas and specific thematic fields for building capacities and addressing key challenges of today and tomorrow. As noted above, with the new National Science, Technology and Innovation Strategy 2011-2016, priority areas were identified as automotive, machinery and production technologies, ICT, energy, water, food, security and space. Along with these areas, stimulating innovation in traditional sectors and addressing societal challenges such as climate change mitigation and health can help increase innovation outputs and outcomes.
5. Increasing availability and quality of research personnel: As evident by indicators, Turkey is behind countries with similar industrial structure and knowledge capacity with respect to human resources intensity, and on the knowledge-intensity of its economy (reflecting both manufacturing and services). (IUC 2011). This has long been recognised as one of the challenges of the Turkish research and innovation system by the government and specific interventions have helped improvements in trends. Current strategies and action plans indicate ongoing commitment in this area. Further efforts and diversified measures are needed to develop human resources in a way that the absorptive capacity of companies is enhanced, and the quantity and quality of researchers are increased. The BTYK decisions of December 2011 support the steps to be taken to tackle this challenge.

In Turkish R&D and innovation policy, there is a clear shift from horizontal focus to sectoral focus. Another remarkable shift is the move from research to innovation. In general research and innovation started to play more important role in the overall national/regional policy mix and there is now an increased commitment to develop and implement strategic, coherent and integrated policy framework.

The process of the harmonisation with the EU *acquis* contributes to above efforts, as it did so far. Although not a Member State yet, Turkey's strategies and efforts in the field S&T and innovation are, to a large extent, in line with the ERA pillars/objectives. In addition, R&D objectives of Turkey are in parallel with the ERA targets. The ERA

developments have been closely followed by the policy-makers and the BTYK launched the “Turkish Research Area” (TARAL) in 2004 with inspiration from the ERA.

For the short and medium term, it is important that innovation is placed at the heart of the development and growth process, and is integrated and embedded in each policy area. It is expected that the new governance system and existing high-level commitment for achieving the new targets set for 2023 will contribute to the enrichment of the policy mix with the design and implementation of new instruments.

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1 Introduction

The Turkish economy ranks 17th in the 2010 list of world economies (IMF, 2011). The country has a population of 73.7m (TURKSTAT, 2011), accounting for 14.7% of the population of the EU-27 (EUROSTAT, 2011). 67% of the population are between 15-64 years of age and half is younger than 29. The gross domestic products (GDP) per capita in 2010 was €7,598 (TL15,119).⁵ While the annual average growth rate was 1.8% between 2008 and 2010 in real terms, Turkey achieved a GDP growth of 9% in 2010 (GDP in 2010 was €554,829m (TL 1,103,750 m)). The GDP realised in the first three quarters of 2011 was €412,214m (TL 957,326m) (TURKSTAT, 2011).⁶

The R&D intensity in Turkey was 0.84% in 2010 (TURKSTAT, 2011). While it is below the EU-27 average of 2% (EUROSTAT, 2011), the gross expenditure on R&D increased by 28% between 2008 and 2010 in real terms.⁷ According to TURKSTAT, 45.1% of R&D expenditures were financed by business enterprises, 30.8% by government sector, 19.6% by higher education sector, 3.7% by other national sector and 0.8% by foreign funds in 2010.⁸ The Business Expenditure on Research and Development (BERD) undertaken in Turkey in 2010 was €2,097m (TL 4,172m).⁹ It was increased by 24% in real terms since 2008. In 2010, the Higher Education R&D (HERD) was €2,267m (TL4,511m). This represents an increase of €491m (TL1,144m) since 2008 (a 34% increase in real terms). Government Expenditure on R&D (GOVERD) stood at €564 (TL1,122m) in 2010 representing an increase of €81m (TL207m) since 2008 (a 23% increase in real terms). The government earmarked an amount of €773,73m (TL 1,796.92m) for funding R&D in 2011¹⁰. The total amount of R&D funding between 2008 and 2010 was €3,262.59m (TL6,824.47m) (BTYK23, 2011¹¹, TUBITAK, 2010¹², MoSIT, 2011¹³).

The number of full-time equivalent (FTE) R&D personnel increased to 81,792 in 2010 from 67,244 in 2008, according to TURKSTAT.¹⁴ The private sector employs 37,522

⁵ €1=TL1.99 http://www.tuik.gov.tr/PrelstatistikTablo.do?istab_id=1221

⁶ €1=TL2.32 <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=8651>

⁷ Expressed in 2011 constant prices
http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/istatistikler/BTY05.pdf

⁸ http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/istatistikler/BTY25.pdf

⁹ Expressed in 2011 constant prices
http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/istatistikler/BTY15.pdf

¹⁰ According to BTYK23, 2011 and data provided by the Ministry of Finance in January 2012

¹¹ http://www.tubitak.gov.tr/tubitak_content_files//BTYPD/btyk/23/BTYK23_Gelismeler.pdf

¹²

http://www.tubitak.gov.tr/tubitak_content_files//BTYPD/arsiv/Turkiye_BTY_Sistemi_Performans_Gostergeleri_2010.pdf

¹³ <http://sagm.sanayi.gov.tr/ServiceList.aspx?catID=998>

¹⁴ http://www.tuik.gov.tr/PrelstatistikTablo.do?istab_id=3

FTE R&D staff and universities employ 32,913 FTE R&D personnel while 11,357 FTE R&D personnel is employed by the public sector.

In Turkey, 165¹⁵ universities employ around 111,000¹⁶ academic staff and the total number of students is around 4 million¹⁷ (OSYM, 2011). There were 1,723,602 female and 2,093,484 male students attending higher education institutions in the period 2010-2011.¹⁸ The numbers of female and male students attending PhD degree programmes in the same period were 19,185 and 24,220, respectively.¹⁹

The public research institute and private research centres established in and out of technology parks are among the significant stakeholders for knowledge production in the Turkish research system. There are 69 public research institutions in the country.²⁰ The most active public research institutes are those established by the Scientific and Technological Scientific and Technological Research Council of Turkey (TUBITAK), the research institutes of the General Directorate for Agricultural Research of the Ministry of Agriculture and Rural Affairs (TAGEM). There are also 134 centres of expertise and centres of excellence at universities and public research organisations established with the support of Ministry of Development between 2003 and 2010. In addition, there are 106 private research centres established by the research-intensive companies and multinationals located in Turkey with the help of the R&D tax incentives (as of 16 December 2011) (BTYK23, 2011).

Turkey has the third highest ratio in OECD countries in terms of increase in total scientific publications between 2003 and 2010 (114%) and it ranks 15th with a 95% increase in scientific publications per million populations for the respective period. In science citation, the rate of increase in the same period reached approximately 111% from 63,000 in 2003 to 133,000 in 2010 (BTYK23, 2011).

The national patent applications to the Turkish Patent Institute (TPE) increased remarkably from 490 in 2003 and to 3,250 in 2010. PCT patent applications have also increased in the same period from 112 in 2003 to 480 in 2010. While Turkey ranks 20th in OECD countries in PCT patent applications in 2010, the rate of growth between 2003-2010 is 329%, which is the third highest in OECD countries. The national patent applications to the European Patent Office (EPO) increased from 68 in 2006 to 248 in 2010. Raising the number of triadic patents is one of the objectives of the Turkish S&T policy. It was increased from 8 in 2003 to 24 in 2009 (BTYK23, 2011).

Micro enterprises dominate the enterprise sector (93.8% of firms in manufacturing industry and 99.1% of those in services sector are enterprises with less than 10 employees). While their share in the total number of enterprises and employment is high (98.1% and 57.4%, respectively) they account for 28.1% total value added as opposed

¹⁵ http://www.yok.gov.tr/index.php?option=com_docman&task=doc_download&gid=613

¹⁶ <http://www.osym.gov.tr/dosya/1-58218/h/2ogretimelemanlarisayozettablosu.pdf>

¹⁷ <http://www.osym.gov.tr/dosya/1-58207/h/1ogrencisayozettablosu.pdf>

¹⁸ <http://www.osym.gov.tr/dosya/1-58207/h/1ogrencisayozettablosu.pdf>

¹⁹ <http://www.osym.gov.tr/dosya/1-58221/h/22enstituleregorelisansustu.pdf>

²⁰ Data provided by the Ministry of Development in January 2012

to 28.8% by small and medium enterprises and 43% by large firms (OECD 2010). The sub-sectors with the highest percentage of BERD are “Computer Programming, Consultancy and Related Activities”, “Motor Vehicles, Trailers And Semi-Trailers” and “Architectural and Engineering Activities, Technical Testing and Analysis, Scientific Research and Development” with around 45% of total expenditures. (TURKSTAT, 2011)²¹ Turkey is the most popular destination after China for FDI from transition economies according to UNCTAD World Investment Report 2011.²² FDI inflow between 2006-2010 was €58,402m (USD 79,218m). The electric, gas and water supply sectors and financial intermediation sectors have attracted the highest amount of FDI in 2010. The majority of FDI was attracted from EU member states (mainly France, Germany, the UK, Italy and the Netherlands), other European countries and Asian countries (Central Bank of the Republic of Turkey, 2011).²³

Turkey has a well-developed national research and innovation system which is led by the Supreme Council of Science and Technology (BTYK), a legally formalised body chaired by the prime minister. The BTYK determines, directs and co-ordinates research and innovation policies. It is composed of 21 permanent members from leading bodies of the national innovation system. The BTYK meets twice a year. Other relevant stakeholders are also invited to the meetings with advisory capacity. In total, over one hundred different actors from the governmental bodies, higher education and business enterprise sectors are represented in the meetings. The Scientific and Technological Research Council of Turkey (TUBITAK), affiliated to the Ministry of Science, Industry and Technology (MoSIT), acts as the secretariat of the BTYK. The MoSIT replaced the former Ministry of Industry and Trade after the elections in June 2011. The science, technology and innovation-related duties of the MoSIT are defined as the development, implementation and coordination of the S&T and innovation policies, and the promotion of the R&D and innovation projects, activities and investments. Another recent development, which has an influence on the governance system, is the creation of two new ministries in June 2011: the Ministry of Development (MoD) and the Ministry of Economy (MoE). The MoD replaces the former State Planning Organisation and is responsible for providing advice to the government and preparing national plans, policies, strategies and programmes, and coordinating regional development agencies, among other things. The Turkish Statistical Institute (TURKSTAT) reports to the MoD. The MoE is responsible for developing and implementing foreign trade and foreign direct investment policies, and investment incentives, among others. The High Planning Council (YPK) is also an important actor in the design and implementation of science, technology and innovation policies since it is the highest-level body for the design and implementation of the national development plans which contain actions on R&D and innovation-related issues, among other things. The Ministry of National Education (MoNE) and the Higher Education Council (YOK) design and implement education policies, and integrate them with research policies. The Turkish Academy of Sciences (TUBA), affiliated to the MoSIT, determines and recommends scientific priority areas

²¹ http://www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=1

²² www.unctad-docs.org/UNCTAD-WIR2011-Full-en.pdf

²³ <http://www.invest.gov.tr/en-US/investmentguide/investorsguide/Pages/FDIinTurkey.aspx>

and proposes legislation to the government on issues related to scientists and researchers.

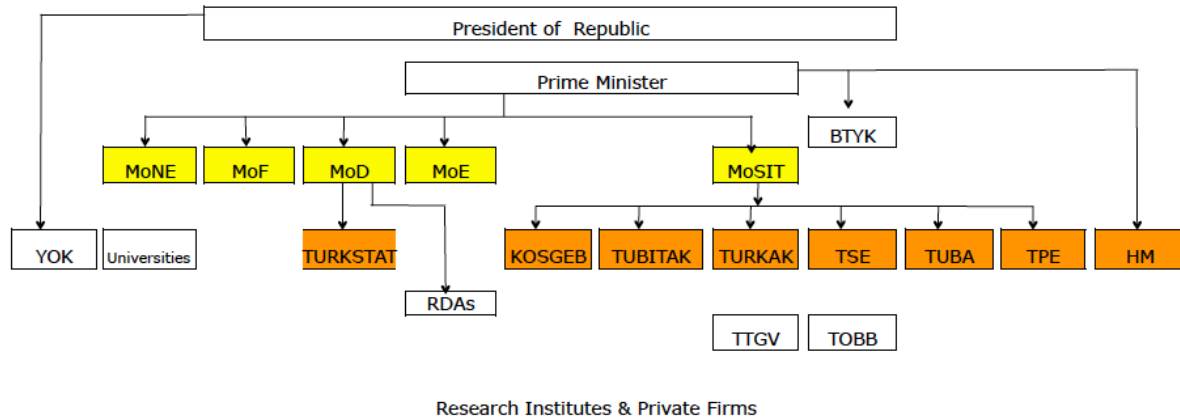
At the operational level, the new Directorate-General for Science and Technology of MoSIT is responsible for the design, implementation, coordination, monitoring and evaluation of science, technology and innovation policies and programmes. TUBITAK designs and implements programmes supporting R&D and innovation activities of the public and private sectors and universities. The Small and Medium Enterprises Development Organisation (KOSGEB) and the Technology Development Foundation of Turkey (TTGV) are the other main bodies implementing R&D and innovation support measures. The Turkish Patent Institute (TPE) carries out the procedures and raises awareness on industrial and intellectual property rights. The Turkish Accreditation Agency (TURKAK) deals with the accreditation of local and international bodies and laboratories. The Turkish Standards Institute (TSE) implements activities related to standards preparation, testing and certification. The Union of Chambers and Commodity Exchanges of Turkey (TOBB) acts as an intermediary between the private sector and rest of research system.

The primary research performer in the public sector is the Marmara Research Centre of TUBITAK. It provides contractual research, testing, training, consultancy, analysis and certification services in its research centres, and operates a technopark. TUBITAK's institutes are the most active research organisations conducting research in their fields of specialisation. For nuclear research activities, the Turkish Atomic Energy Institute is the main body both for strategy preparation and for carrying out research activities. There are also the R&D centres operating under universities and various ministries, such as the ministries of Energy and Natural Resources, and Agriculture and Rural Affairs. Universities are also leading actors in the system as the key group of research performers. There are 165 universities of which 62 are privately owned.²⁴

Turkey is a unitary state where all policy fields and their governance, including research and innovation, are under the responsibility of the central government. On the other hand, the regional development agencies (RDA), which operate under the coordination of the MoD, design and implement programmes for stimulating R&D and innovation in their regions. The RDAs have also started to take initiatives to develop and implement regional innovation strategies by 2011.

²⁴ http://www.yok.gov.tr/index.php?option=com_docman&task=doc_download&gid=613

Figure 1: Overview of the Turkey’s research and innovation system governance structure



- | | | | |
|--------|--|-----------|---|
| BTYK: | Supreme Council of Science and Technology | TUBITAK: | Scientific and Technological Research Council of Turkey |
| MoF: | Ministry of Finance | KOSGEB: | SME Development and Support Organisation |
| MoSIT: | Ministry of Science, Industry and Technology | HM: | Undersecretariat of Treasury |
| MoNE: | Ministry of National Education | YOK: | Higher Education Council |
| MoD: | Ministry of Development | TUBA: | Turkish Academy of Sciences |
| MoE: | Ministry of Economy | TSE: | Turkish Standards Institute |
| | | TURKSTAT: | Turkish Statistical Institute |
| | | RDAs: | Regional Development Agencies |
| | | TTGV: | Technology Development Foundation of Turkey |
| | | TURKAK: | Turkish Accreditation Agency |
| | | TPE: | Turkish Patent Institute |
| | | TOBB: | Union of Chambers and Commodity Exchange of Turkey |

2 Structural challenges faced by the national system

In the Innovation Union Scoreboard (IUS) 2010²⁵, Turkey belongs to the “Modest innovators with a below average performance”. For Turkey, the improvement of innovation performance has been well above the EU27 average in 2008/2009²⁶ (approximately 4%). According to the IUS 2010, the relative strengths are in ‘Open, excellent and attractive research systems’ and ‘Innovators’. The Innovation Union Competitiveness (IUC) Report²⁷ also highlights a specific relative strength of Turkey in the quality of its scientific production, with 6.9% of its scientific publications among the top 10% of those most cited worldwide (IUC, 2011). According to the IUS 2010, relative weaknesses are in ‘Human resources’, ‘Intellectual assets’ and ‘Firm investments’. The first two weaknesses are confirmed by the IUC report: It is mentioned that “Turkey’s R&D profile is weaker than that of the EU average, in particular new doctoral graduates and patenting activity”. The IUC report also notes that “Turkey is behind countries with similar industrial structure and knowledge capacity with respect to human resources

²⁵ <http://www.proinno-europe.eu/inno-metrics/page/innovation-union-scoreboard-2010>

²⁶ According to IUS 2010, the average performance in 2010 reflects performance in 2008/2009 due to a lag in data availability.

²⁷ <http://ec.europa.eu/research/innovation-union/pdf/competitiveness-report/2011/iuc2011-full-report.pdf#view=fit&pagemode=none>

intensity, and on the knowledge-intensity of its economy (reflecting both manufacturing and services)"²⁸.

Both the IUS 2010 and IUC 2011 reports underline high growth for 'Business R&D expenditure' and 'PCT patent applications'. As for the 'PCT patent applications in societal challenges', while the IUS report notes a strong decline for this indicator, the IUC report provides an explanation to this situation: "PCT patent applications in societal challenges (defined as climate change mitigation and health) are not primary S&T priority areas in Turkey. Therefore, this indicator may not reflect the patenting dynamics of Turkey"²⁹ (IUC, 2011).

The IUS 2010 underlines that growth performance in 'Human resources', 'Open, excellent and attractive research systems', 'Firm investment', and 'Intellectual assets' is above average. Growth in the main research and innovation indicators between 2000-2009 (R&D intensity, business R&D expenditures on R&D, public expenditures on R&D, new doctoral graduates, scientific publications within the 10% most cited scientific publications worldwide and PCT patent applications), except for patent activity in societal challenges, is reported in the IUC 2011.

The IUC report also highlights Turkey's improvement in human resources for research and innovation, and in knowledge transfer from public research to business enterprise over the period 2000-2008 (as measured by the public sector expenditure on R&D financed by business enterprise as % of GDP). This is particularly important given the relatively good performance of Turkey in scientific quality output (IUC, 2011).

According to the Global Competitiveness Report 2010-2011³⁰ of the World Economic Forum, Turkey's performance in innovation pillar is comparable with other 'efficiency-driven economies'. Under the innovation pillar, Turkey's scores relatively well in the availability of scientists and engineers (44th out of 139 economies) and capacity for innovation (55th). Moderate performance is observed in company spending on R&D (62nd) and government procurement of advanced technology products (62nd) and utility patents per million of population (70th). On the other hand, university-industry collaboration in R&D (82nd) and quality of scientific research institutions (89th) remain areas of concern for the country.

The National Science, Technology and Innovation Strategy 2011-2016 adopted in December 2010 by the BTYK focuses on human resources development for science, technology and innovation, transformation of research outputs into products and services, enhancing interdisciplinary research, highlighting the role of SMEs, R&D infrastructures and international cooperation. It also identifies automotive, machinery and production technologies, ICT, energy, water, food, security and space as focus

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http://ec.europa.eu/research/innovation-union/pdf/competitiveness-report/2011/country_review.pdf#view=fit&pagemode=none (pp. 250)

29

http://ec.europa.eu/research/innovation-union/pdf/competitiveness-report/2011/country_review.pdf#view=fit&pagemode=none (pp. 250)

³⁰ http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2010-11.pdf

areas. In line with this, the strategy puts special emphasis on keeping the balance between focused areas and bottom-up research (TUBITAK, 2010 and IUC, 2011).

In addition to the National Science, Technology and Innovation Strategy 2011-2016, at the BTYK meeting in December 2011, the following new items were identified for the improvement of the research and innovation performance of the country:³¹

- Setting up a coordination board to secure integrity, coherence and target-oriented approach in R&D, innovation and entrepreneurship support mechanisms;
- Developing policy tools to activate and increase the number of R&D intensive start-ups;
- Developing policy tools to trigger innovation and entrepreneurship in universities;
- Promoting entrepreneurship culture;
- Improving public procurement and public right of use in such a way to foster innovation, localisation and technology transfer;
- Promoting science centres;
- Developing policy tools to stimulate domestic patent licensing.

Above-mentioned items are in line with the challenges and weaknesses highlighted in the previous ERAWATCH Country Reports³² and TrendChart reports³³ of Turkey.

Based on above indicators and issues, the following challenges are identified for Turkey:

1. Promoting research commercialisation from universities: This can take place in various forms, such as university start-ups and spin-off, mobility of researchers and students, contract research projects, joint research projects, innovative public procurement, licensing, consulting, trainings, formal and informal networks, competitiveness clusters etc. The above-listed new decisions of the BTYK and the National Science, Technology and Innovation Strategy 2011-2016 focus on this challenge. The enrichment of the policy mix with a variety of measures (financial, non-financial, etc.) will help address this challenge.
2. Increasing the number of innovative high-growth start-ups: This is an important challenge facing the innovation and economic performance of the country. The underdeveloped venture capital and business angels market, as well as limited number and variety of policy measures for start-up creation, are crucial impediments for the establishment and development of innovative businesses in Turkey. It is also a barrier for encouraging educated and qualified human sources to see entrepreneurship as a career option. Insufficient early stage funding is also an obstacle for the development of venture capital industry as it helps generate a

³¹

<http://www.tubitak.gov.tr/sid/0/pid/0/cid/26210/index.htm;jsessionid=99F0D41EDD150485B88A89300B4B0C62>

³² <http://erawatch.jrc.ec.europa.eu>,

³³ http://www.proinno-europe.eu/extranet/upload/countryreports/Country_Report_Turkey_2009.pdf,
http://www.proinno-europe.eu/extranet/upload/countryreports/Country_Report_Turkey_2008.pdf

large deal flow for venture capital investments. The BTYK decisions of December 2011 recognise this challenge and aim to address through new policy measures. Furthermore, the Undersecretariat of Treasury carries out studies for improving the framework conditions for angel investments, and the 'Entrepreneurship Council' established in January 2012 aims to increase number of innovative and technology-based start-ups³⁴.

3. Increasing R&D and innovation capabilities of the private sector (in particular, micro, small and medium enterprises (MSMEs)): The low levels of absorptive capacity of the business sector, particularly that of MSMEs is a barrier to increase R&D and innovation performance. MSMEs constitute 99.9% of the total enterprises and 78% of employment in Turkey, according to KOSGEB. As noted previously, micro enterprises constitute the majority of MSMEs. They are mainly active in traditional, middle to low-tech sectors, such as garments (14%), furniture (14%), metal products (14%), wood products (10%) and food (8%) (KOSGEB 2011).³⁵ There exist policy measures for increasing R&D and innovation investment of the private sector and SMEs, and the National Science, Technology and Innovation Strategy 2011-2016 highlights the role of SMEs. It is important to design and implement specific measures (such as support for R&D/innovation vouchers and knowledge intensive service activities, etc.) for enhancing the learning capabilities, absorptive capacity, and R&D and innovation capabilities of MSMEs and other private sector companies.
4. Focusing on sectors and thematic areas of importance: It is important for Turkey to focus on priority sectors, technology areas and specific thematic fields for building capacities and addressing key challenges of today and tomorrow. This requires incentives and measures specifically designed and government funds strategically channelled to these areas. As noted above, with the new National Science, Technology and Innovation Strategy 2011-2016, priority areas were identified. In addition to these areas, stimulating innovation in traditional sectors and addressing societal challenges such as climate change mitigation and health can help increase innovation outputs and outcomes due to the intensity of enterprises in the former, and the size of societal needs in the latter.
5. Increasing availability and quality of research personnel: As evident by indicators, Turkey is behind countries with similar industrial structure and knowledge capacity with respect to human resources intensity, and on the knowledge-intensity of its economy (reflecting both manufacturing and services). (IUC 2011). This has long been recognised as one of the challenges of the Turkish research and innovation system by the government and specific interventions have helped improvements in trends. Current strategies and action plans indicate ongoing commitment in this area. Further efforts and diversified measures are needed to develop human resources in a way that the absorptive capacity of companies is enhanced, and the quantity and quality of researchers are increased. The BTYK

³⁴ <http://www.sanayi.gov.tr/NewsDetails.aspx?newsID=2292&lng=tr>

³⁵ <http://www.kosgeb.gov.tr/Pages/UI/Baskanligimiz.aspx?ref=23>

decisions of December 2011 support the steps to be taken to tackle this challenge.

3 Assessment of the national innovation strategy

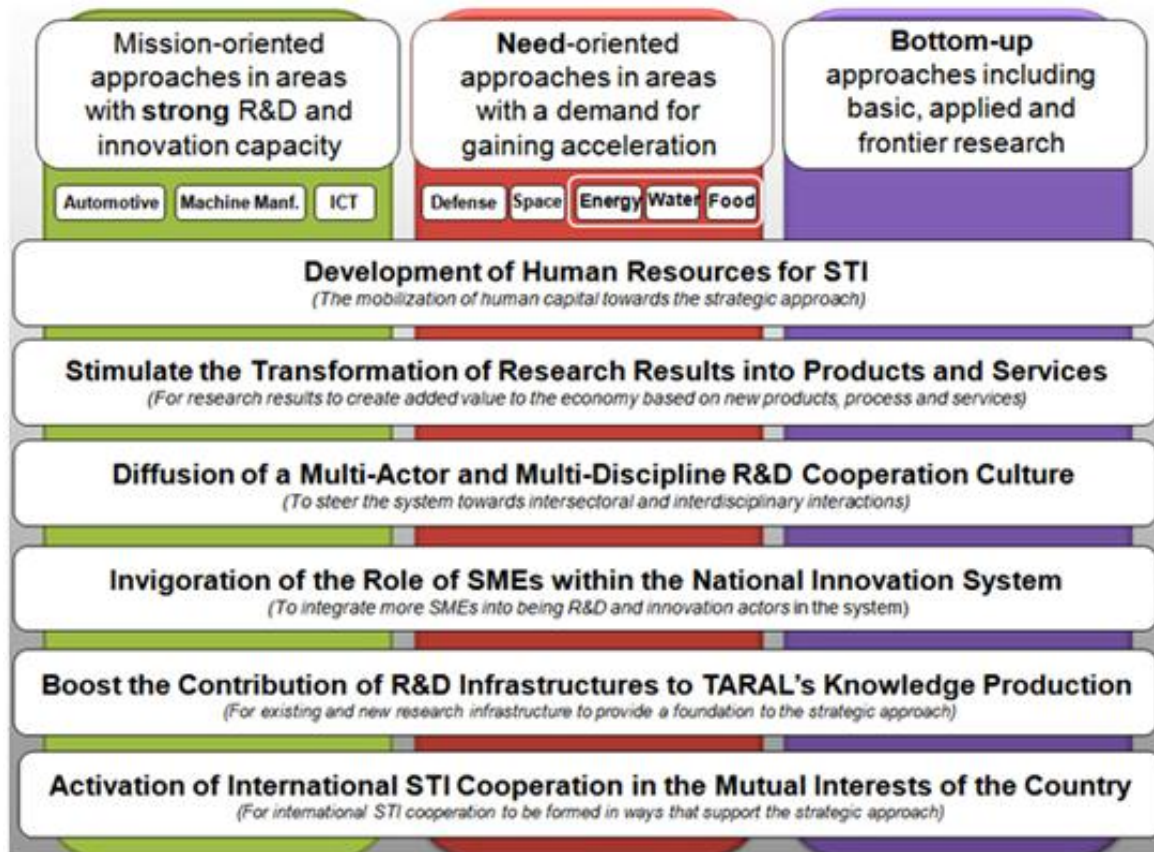
3.1 National research and innovation priorities

The BTYK approved the National Science, Technology and Innovation Strategy (2011-2016) on 15 December 2010. The continuation of the pace of the improvement of R&D and innovation capacity achieved through the National Science and Technology Policies Implementation Plan for 2005-2010 have been one of the main motives behind the new strategies. The strategies aim at disseminating culture of multilateral and multidisciplinary R&D and innovation cooperation, stimulating sectoral and regional R&D and innovations dynamics, encouraging SMEs to become stronger actors within the national innovation system, and enhancing the contribution of research infrastructures to the knowledge creation capacity of the Turkish Research Area (TARAL)³⁶.

As explained by TUBITAK, in order to meet these aims, mission oriented approaches in areas with strong RDI capacity, need-oriented approaches in areas with a demand for gaining acceleration, and bottom-up approaches including basic, applied and frontier research are identified under the new strategy, and the strategic framework has been set in such a way that it comprises of three vertical axes and six horizontal axes that cross-cuts the vertical ones (Figure 2).

³⁶ <http://www.tubitak.gov.tr/sid/2415/pid/2400/index.htm>

Figure 2: Strategic Framework of the National Science, Technology and Innovation Strategy (2011-2016)



Source: TUBITAK (<http://www.tubitak.gov.tr/sid/2415/pid/2400/index.htm>)

As noted above, automotive, machinery and production technologies, ICT, energy, water, food, security and space were identified as priority sectors under the strategy. The National R&D and Innovation Strategies were developed and approved for Energy, Water and Food by the BTYK in December 2011. This indicates a clear shift in R&D and innovation policy-making from horizontal to sectoral focus.

Another remarkable shift is the move from research to innovation. While the National Science and Technology Policies Implementation Plan for 2005-2010 was mainly characterised by outlining research oriented strategies, the National Science, Technology and Innovation Strategy (2011-2016) started to discuss aims to transform research outputs into products and services. Finally, the new BTYK decisions taken at its meeting on 27 December 2011, as noted above, put high emphasis on innovation, and link innovation with entrepreneurship.³⁷

The new priorities also include governance improvements. The new decision of the BTYK for the coordination and coherence between policy measures is an important commitment in this respect. In addition, the creation of the new Ministry of Science,

³⁷

<http://www.tubitak.gov.tr/sid/0/pid/0/cid/26210/index.htm;jsessionid=99F0D41EDD150485B88A89300B4B0C62>

Industry and Technology, which is given the responsibility for the development, implementation and coordination of the S&T and innovation policies, increases the priority of governance improvements in the policy agenda.

When the national priorities are compared with the structural challenges presented in Section 2, it is observed that the current priorities recognise and address the challenges identified, as explained above.

The new policy changes are not yet reflected on the policy mix of measures as they have very recently been introduced. The characterisation of the policy instruments to foster public and private R&D investment is summarised below.

Route 1: Promoting the establishment of new indigenous R&D performing firms

As part of the broader industrial and innovation policy framework, the leading programmes aiming to encourage creation of new technology-based firms include the new 'R&D, Innovation and Industrial Application Support Programme' of KOSGEB and 'Technopreneurship Support Programme' of the MoSIT. The former is the follow up of the 'R&D and Technological Innovation Support Programme' which was replaced in mid-2010. The programme is composed of two sub-programmes: R&D and Innovation Programme, and Industrial Application Programme. 512 projects were funded with a support budget of €10.70m (TL24.85m) in the scope of the R&D and Innovation Programme (as of October 2011). The number of supported projects was 96 and the total support amount was €3.03m (TL7.04) for the Industrial Application Programme in the same period (BTYK23, 2011). The programme also supports technology incubators (called 'Technology Development Centres') of KOSGEB, which are established in cooperation with universities and local chambers to support technology start-ups.

In 2009-2011 period, the MoSIT allocated €19.94m (TL44m) to 452 entrepreneurs to start their technology-based business. With the amendment to the 'Law on Supporting Research and Development Activities' in 2011, the annual budget allocated by the MoSIT for the Technopreneurship Support Programme increased from €4.30m (TL10m) to €21.53m (TL50m). A total amount of €11.35m (TL28.6m) was allocated to the supported projects in 2011 (BTYK23, 2011).

Route 2: Stimulating greater R&D investment in R&D performing firms

The primary focus of the measures in Turkey is on increasing the R&D investments of companies in general. The main instruments implemented for this purpose cover subsidies in the form of grants and soft loans as well as fiscal incentives. The leading measure is the 'Support Programme for Industrial R&D Projects' which aims to increase R&D activities of the private sector and is implemented by TUBITAK. By October 2011, €50.25m (TL116.7m) was provided to R&D projects of the private sector under this programme. The support amount was €161.26m (TL230.6m) and €115.92m (TL346.8m) for 2010 and 2009 respectively (BTYK23, 2011).

Another similar measure is the Technology Development Project Support programme of TTGV. The amount provided as soft loan to the supported projects was €7.19m (TL16.7m) in 2011. The funding provided to the new and ongoing projects were €10.7m (TL21.3m) in 2010 and €15.11m (TL32.5m) in 2009. Under the Advanced Technology Projects Support Programme (ITEP), which was initiated in 2011, TTGV allocated €4.98m (USD6.93m) for selected projects (BTYK23, 2011).

Tax incentives are provided under the 'Law of Technology Development Zones' and the 'Law on Supporting Research and Development Activities'. The former provides tax exemption to R&D activities of tenants of technoparks while the later is used by companies located outside the technoparks and employing at least 50 researchers (in case they have been entitled as "R&D Centre" by the MoSIT). As of November 2011, there were 1,746 companies with 12,318 R&D personnel in 31 active technoparks. The MoSIT granted the 'R&D centre' status to 106 companies as of December 2011 (BTYK23, 2011). Their amount of R&D expenditures between 2008 and 2010 was estimated as €2,467m (TL 4,976m) (MoSIT, 2011).³⁸

The KOSGEB programme mentioned in route 1 above also covers this route and the route 3 below.

Route 3: Stimulating firms that do not perform R&D yet

Apart from the above-mentioned KOSGEB support for SMEs, the only scheme available to stimulate firms that do not perform R&D yet is the 'SME Funding Programme' implemented by TUBITAK. It aims to increase the number of R&D projects carried out by SMEs by offering a much faster and easier access for funding. €39.76m (TL 85.5m) and €34.18m (TL 68m) was provided to the R&D projects of SMEs in 2009 and 2010, respectively. In 2011, an amount of €20.67m (TL 48m) was allocated to the projects under this programme as of October 2011 (BTYK23, 2011).

Route 4: Attracting R&D-performing firms from abroad

Attracting FDI is one of the priorities of the government. However, there are no direct measures for pulling research-intensive FDI. The 'Law on Supporting Research and Development Activities' which provides fiscal incentives for R&D activities of firms employing at least 50 researchers is expected to be used as a stimuli to attract foreign firms which would like to locate their R&D branches outside their home countries. The tax exemptions provided under the 'Law of Technology Development Zones' has been instrumental in attracting 65 R&D-performing firms from abroad. Their total amount of investments reached €323.59m (USD450m) as of June 2011 (MoSIT, 2011)³⁹.

Route 5: Increasing extramural R&D carried out in cooperation with the public sector

The topic has been on the political agenda for a very long time. One of the programmes implemented for this purpose is the 'Industrial Thesis (San-Tez) Projects' support programme by the MoSIT. By November 2011, the MoSIT provided €13.78m (TL32m) to the projects supported under this programme. The funding provided to the projects in 2010 and 2009 were €10.10m (TL20.1m) and €6.88m (TL14.8m), respectively (BTYK23, 2011). In 2011, TUBITAK introduced the 'Technology Transfer Support Programme for SMEs' aiming to promote technology transfer from universities to SMEs. Two project applications have been received by November 2011 (BTYK23, 2011). Finally, as a part of the 'Support Programme for Research Projects of Public Institutions', it is possible for public bodies to create consortiums with the private sector, universities or public research institutes to conduct joint R&D activities. Since this programme is more related

³⁸ <http://sagm.sanayi.gov.tr/Files/Documents/ar-ge-merkezleri-hakkinda-05102011170733.pdf>

³⁹ <http://www.sanayi.gov.tr/Files/Attachments/OtherFiles/genel-brifing-12-09-2011-28092011161213.doc>

to the increasing R&D in the public sector (and since R&D collaboration with third parties is not mandatory for public organisations) it is covered under the route 6 below.

Route 6: Increasing R&D in the public sector

Involvement of the public sector in R&D activities is another topic that has been debated for more than a decade. The ‘Support Programme for Research Projects of Public Institutions’ aims to address the R&D needs of public organisations. As part of the programme, the public administrations need to identify their needs, which could be solved through R&D projects (also see route 5 above). The total budget allocated for supported projects is €117.1m (TL272m) as of October 2011 (BTYK23, 2011).

In the Turkish policy mix of measures, the route 2 has been given higher importance when compared with the number of measures in other routes. It is expected that with the new policy measures to be introduced to implement the new strategies and decisions of the BTYK, the balance and efficiency of the policy mix will improve in the near future.

Of above programmes, only KOSGEB’s ‘R&D and Technological Innovation Support Programme’ was evaluated in 2010. The evaluation results indicate that the ‘Technology Development Centres’ established under this programme have proved to be successful in the creation of technology start-ups.

3.2 Trends in R&D funding

Turkey continues to increase its research and development (R&D) investments since the turn of the century. The gross expenditure on R&D (GERD/GDP) ratio was increased by 15% over the last three years.⁴⁰ The steady increase shows that the global financial crisis does not have an impact on the overall R&D spending in Turkey. However, between 2008-10, R&D performed by the business sector decreased by 2.9%. R&D performed by universities increased by 5% between 2008-2010. There was 5% decrease in R&D performed by the public sector in the same period.⁴¹

Achieving an R&D intensity of 2% by 2013 has been set by the BTYK as the primary target in 2005. In order to reach this target the government has consistently increased funds allocated for R&D activities. The amounts allocated for R&D in the state budget have not been cut but increased during the global financial crisis: funds allocated in 2008, 2009 and 2010 were €702.14m (TL1,331.10m), €881.39m (TL1,895.45m) and €905.32m (TL1,801m), respectively. In 2011, €773.73m (TL1,796.92) was allocated (BTYK23, 2011).

Table 1: Basic indicators for R&D investments in Turkey

	2008	2009	2010	EU average 2010
GDP growth rate	0.7	-4.8	9.0	2.0
GERD as % of GDP	0.72	0.85	0.84	2.0

⁴⁰ http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/istatistikler/BTY01.pdf

⁴¹ http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/istatistikler/BTY15.pdf

	2008	2009	2010	EU average 2010
GERD per capita	51.1	52.4	63.2	490.2
GBAORD (€ million)	-	-	-	92,729.05
GBAORD as % of GDP	-	-	-	0.76
BERD (€ million)	1,596	1,497	2,097[2]	151,125.56
BERD as % of GDP	0.32	0.34	0.35	1.23
GERD financed by abroad as % of total GERD	1.3	1.1	0.8	N/A ⁴²
R&D performed by HEIs (% of GERD)	43.8	47.4	46.0	24.2
R&D performed by PROs (% of GERD)	12.0	12.6	11.4	13.2
R&D performed by Business Enterprise Sector (as % of GERD)	44.2	40.0	42.5	61.5

[1] GDP at market prices; Percentage change on previous period

[2] Expressed in 2011 constant prices,

http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/istatistikler/BTY15.pdf

Sources: 2010 EUROSTAT, 2010 TURKSTAT

The national R&D targets of Turkey for 2023, which were agreed by the BTYK on 27 December 2011, include the following:

- Achieving an R&D intensity of 3% (from 0.84% in 2010)
- Increasing business R&D expenditure as % of GDP to 2% (from 0.36% in 2010)
- Increasing the number of FTE researchers to 300,000 (from 64,341 in 2010)
- Increasing the number of FTE researchers in the private sector to 180,000 (from 25,342 in 2010).

In terms of the number of policy instruments, the majority of mechanisms in the policy mix are project-based competitive funding programmes, which provide direct funding to R&D projects of the private sector, academia and public institutions. In most of the programmes, collaborations between different actors of the system are not obligatory. In terms of budget, nearly half of the state funding is allocated to competitive programmes: In 2011, nearly 37% of the state budget for R&D was allocated to project-based subsidies, while 25% was earmarked for public research institutes and 38% was allocated to universities.⁴³ On the other hand, two major measures providing tax incentive for R&D (the 'Law of Technology Development Zones' and the 'Law on Supporting Research and Development Activities') are considered as powerful tools in the R&D support system in Turkey.

⁴² 8.4 (2009), 9.04 (2005)

⁴³ According to BTYK23 (2011) and data provided by the Ministry of Finance.

The funds are mainly provided from the national public budget. Other national or international sources, as well as public-private partnerships are not used to complement national funding. The highest portion of funds is allocated as grants; the other forms of finance, such as venture capital, are fairly limited.

The support mechanisms tend to be horizontal in nature and a majority of them do not focus on thematic issues. Defence, security and space research are the fields supported through thematic schemes. As of 2011, the budget for the supported projects under these thematic areas was €1,796.92m (TL580m)⁴⁴. As noted above, the new S&T and innovation strategy document also focuses on thematic areas for R&D investment, and three separate national R&D and innovation strategy documents were prepared in 2011 for the priority thematic areas of energy, water and food. R&D investments in each of these areas will be promoted under the prime minister's initiative. It is expected that the policy mix will be enriched with programmes addressing these areas.

Overall, the trends in R&D funding are expected to be changed in the near future with the new policy measures to be introduced for the implementation of the new strategies and decisions of the BTYK.

Transnational or inter-regional funding as a complement to the national funding is not important in Turkey.

3.3 Evolution and analysis of the policy mixes

A brief description of the policy mix and its evolution over the last three years are given below:

- Fiscal policies: The government continued to implement two important fiscal incentives (namely, the 'Law on Technology Development Zones' and the 'Law on Supporting Research and Development Activities') to stimulate R&D and innovation activities. The estimated value of the foregone revenues in 2010 due to these R&D tax incentives was €749.99m (TL1,492m) while it was €736.74 (TL1,711m) in the first half of 2011 (BTYK23, 2011).
- Human resources policies: The development of human resources for science and technology is high in the agenda of the BTYK. It is the first strategic aim of the National Science, Technology and Innovation Strategy 2011-2016. In December 2010, the National Science and Technology Human Resources Strategy and Action Plan (2011-2016) was approved by the BTYK⁴⁵. The BTYK decisions taken in December 2011 include a large number of action items planned to improve HRST which support above-mentioned strategy⁴⁶.
- Knowledge triangle policy mix:

⁴⁴ http://www.tubitak.gov.tr/tubitak_content_files//BTYPD/btyk/23/BTYK23_Gelismeler.pdf

⁴⁵

http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/tr/country?section=PolicyMix&subsection=HumanResourcesPolicies

⁴⁶ http://www.tubitak.gov.tr/tubitak_content_files//BTYPD/btyk/23/BTYK23_Gelismeler.pdf

- Research policies: As noted before, the research policies in the National Science, Technology and Innovation Strategy (2011-2016) attach higher importance to research-innovation linkages. They focus on transforming research outputs into products and services, enhancing interdisciplinary research, further developing R&D infrastructures and bottom-up research, among other things. They also aim at improving R&D capacity in automotive, machinery and production technologies, ICT, energy, water, food, security and space. Three new thematic national R&D and innovation strategies developed for energy⁴⁷, water⁴⁸ and food⁴⁹, approved by the BTYK in December 2011, outline the strategies and actions for enhancing R&D and innovation capacities, outputs and outcomes in these areas.
- Innovation policies: Since 2008, the importance of innovation in the policy agenda has grown significantly. Particularly the new BTYK decisions of December 2011 put higher emphasis on innovation indicating an increased commitment of the government. The two key focus areas in these decisions are the stimulation of innovation in universities, promoting public procurement for innovation while the other areas of focus (such as stimulating domestic patent licensing) emphasise R&D and innovation linkages.
- Education policies: With the emphasis on the development of human resources for research and innovation, the role of Ministry of National Education in the system has strengthened and closer interaction between education, research and innovation has been established.
- Other policies: In addition to above policy areas, the following policies have also started to play an important role in the policy mix.
 - Regional policies: The regional development agencies (RDAs) in 26 NUTS2 regions in Turkey started to focus on R&D and innovation strategies and programmes. While some RDAs initiated studies for the development of regional innovation strategies in 2011, others launched calls to support R&D and innovation projects in their regions.
 - SME, industrial and entrepreneurship policies: The main policy documents (such as the SME Strategy and Action Plan 2011-201350 and the Turkish

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http://www.tubitak.gov.tr/tubitak_content_files//BTYPD/btyk/23/Ek1_Ulusal_Enerji_ArGe_Yenilik_Stratejisi.pdf

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http://www.tubitak.gov.tr/tubitak_content_files//BTYPD/btyk/23/Ek2_Ulusal_Su_ArGe_Yenilik_Stratejisi.pdf

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http://www.tubitak.gov.tr/tubitak_content_files//BTYPD/btyk/23/Ek3_Ulusal_Gida_ArGe_Yenilik_Stratejisi.pdf

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http://www.sanayi.gov.tr/Files/Documents/KOSGEB_Katalog.pdf

Industrial Strategy Document (2011-2014)⁵¹) recognises the importance of R&D.

Furthermore, the policy areas related to the thematic focus areas of the National Science, Technology and Innovation Strategy (2011-2016) (such as energy) started to interact with research and innovation policies.

Based on the above description of the policy mix and its evolution over the last three years, an analysis is provided below using the Innovation Union self-assessment tool (a description of policy features most commonly found in well-performing research and innovation tools was provided by the European Commission in annex to its Europe 2020 Innovation Union communication⁵²).

Table 2: Analysis of the policy mix

Policy feature	Analysis
1. Role of research and innovation	
Strategic policy framework	<ul style="list-style-type: none"> • Research and innovation started to play a more important role in the overall national/regional policy mix • There is an increased commitment among the policy-makers to develop and implement strategic, coherent and integrated policy framework. It is an important challenge to achieve and sustain such a policy framework.
Focus on societal challenges	<ul style="list-style-type: none"> • Energy, water and food are identified as societal challenges and separate national R&D and innovation strategy documents were developed for them in 2011. • There is also a need to focus on climate change mitigation and health as additional challenges to be addressed.
2. Quality of governance	
Governance structure	<ul style="list-style-type: none"> • The new governance structure emerged after the election in 2011 and the role of the new MoSIT defined as the oversight body for research and innovation policies will help improve the quality of governance. • The new BTYK decision aiming to ensure integrity, coherence and target-oriented approach in R&D, innovation and entrepreneurship support mechanisms is an opportunity for enhancing governance. • Achieving better policy coordination is a challenge.
Multi-annual strategy	<ul style="list-style-type: none"> • There exist a multi-annual strategy defining national priorities (National Science, Technology and Innovation Strategy (2011-2016))

⁵¹ http://www.sanayi.gov.tr/Files/Attachments/OtherFiles/turkish_industrial_strate-16022011152724.pdf

⁵² http://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication_en.pdf

Policy feature	Analysis
Monitoring system	<ul style="list-style-type: none"> • There exist national targets for monitoring policy implementation. • There is a need to develop an evaluation culture and establish an effective mechanism for systematic evaluation of the policies and policy measures on the basis of internationally recognised criteria.
3. Scope of innovation policy	
Broad concept beyond RTD	<ul style="list-style-type: none"> • While the scope of current National Science, Technology and Innovation Strategy (2011-2016) does not provide a broad concept beyond RTD the new BTYK decisions imply a broader concept of innovation. • There is a need to adopt a broad concept of innovation in policies and policy measures (including innovation in services, improvements of processes and organisational change, business models etc.)
Demand side aspects	<ul style="list-style-type: none"> • The new BTYK decision aiming to promote public procurement for innovation is an opportunity to increase the demand for innovations and the diffusion of innovations. • There is a need to develop and implement demand-side innovation policies and policy measures.
4. Adequacy of public funding	
Budgetary prioritisation	<ul style="list-style-type: none"> • There exists high-level commitment for allocating higher budget for R&D and innovation funding. • There is a need to ensure sustainability of funding in these areas.
Innovative financing solutions	<ul style="list-style-type: none"> • There exist tax incentives for stimulating R&D and innovation. • There is a need to develop innovative financing solutions (e.g. public-private partnerships, equity finance, etc.) and to stimulate private finance (such as angel investments and venture capital) for R&D and innovation is a challenge. • The new BTYK decisions and the studies carried out by the HM for improving the framework conditions for angel investments are important opportunities.
5. Pursuit of excellence in research and education	
Share of competitive and project-based financing	<ul style="list-style-type: none"> • Allocation of high share of research funding on a competitive basis is a strength and it is important to continue to pursue this strategy.
Evaluation of institutions	<ul style="list-style-type: none"> • There is a need to evaluate research institutions on the basis of internationally recognised criteria.

Policy feature	Analysis
Selection of projects	<ul style="list-style-type: none"> • There exist procedures for the selection of projects on the basis of quality and expected results and subject to external peer review, and it is important to continue to pursue this approach.
Portability of funding	<ul style="list-style-type: none"> • There is a need to ensure portability of researchers funding. • Higher importance attached to researchers mobility at national, sectoral and international levels is an opportunity.
Exploitation of results	<ul style="list-style-type: none"> • There exist measures to stimulate exploitation of results of publicly funded research (protection, publication). • The new BTYK decision aiming at stimulating domestic patent licensing is an opportunity to increase exploitation of research results.
Autonomy of institutions	<ul style="list-style-type: none"> • There exists academic freedom of the academic personnel and the scientific autonomy of the higher education institutions through the protection provided by the Turkish Constitution.
Researcher careers	<ul style="list-style-type: none"> • There exist the National Science and Technology Human Resources Strategy and Action Plan (2011-2016) (HRST strategy) to improve researcher careers.
Attraction of world talent	<ul style="list-style-type: none"> • There exist the HRST strategy aiming to create incentives to attract leading international talent.
6. Education system to produce the right mix of skills	
Supply of graduates	<ul style="list-style-type: none"> • There exist the HRST strategy to ensure a sufficient supply of (post)graduates in science, technology, engineering and mathematics and an appropriate mix of skills. • There is a need to balance supply and demand in HRST, and to increase the number of S&T graduates.
Innovation-oriented education/curricula	<ul style="list-style-type: none"> • There exist the 'Technology and Design Programme' at primary schools with a strong focus on innovation as a three-years compulsory course in the national education curricula. • The new BTYK decisions aiming at stimulating innovation and entrepreneurship in universities and promoting entrepreneurship culture in general is an opportunity.
Link between education and other sectors	<ul style="list-style-type: none"> • There exist the HRST strategy aiming to promote partnerships between formal education and other sectors. • There is a need to increase and sustain partnerships between formal education and other sectors.
7. Partnerships at all levels/between all actors	

Policy feature	Analysis
Bridging instruments e.g. clusters, KT platforms, vouchers	<ul style="list-style-type: none"> • There exist of policy measures aiming to encourage partnership and collaboration between research and innovation stakeholders. • There is a need to enrich the policy mix with instruments to support the commercialisation of innovative ideas such as innovation/knowledge clusters, knowledge transfer platforms, and voucher systems, notably for SMEs.
Sectoral mobility	<ul style="list-style-type: none"> • There are schemes to stimulate mobility between universities and the private sector. • There is a need to create the legal basis, and design and implement policy measures specifically targeting the stimulation of mobility of researchers and innovators between public and private institutions.
IP management rules	a. There exist strategies and new BTYK decisions aiming to establish clear rules on the ownership of IPR & sharing and support systems to facilitate knowledge transfer and the creation of university spin-offs and to attract (venture) capital and business angels.
Transnational cooperation	b. There exist strategies to facilitate setting up/operating transnational partnerships and collaborations for research.
8. Business environment promoting private investment	
Policy mix	1. There exist strategies for promoting private investment in research and innovation.
Venture capital market	<ul style="list-style-type: none"> • There exist strategies for developing venture capital industry and encouraging early stage investments • There is a need to create favourable conditions to foster a growing and robust venture capital market, especially for early stage investments.
Rules for operating firms	<ul style="list-style-type: none"> • Ongoing commitment to improve the business environment through the Coordination Council for the Improvement of Investment Environment' (YOIKK) is an opportunity. • There is a need to improve the rules and procedures and streamline processes for starting up, running and terminating a business.
IPR system	<ul style="list-style-type: none"> • There exist policies and policy actions to improve the system for the protection of IP.
Standard-setting system	<ul style="list-style-type: none"> • There is a need to develop efficient standard-setting system supporting innovative products and services.
9. High quality, simple and accessible public support	

Policy feature	Analysis
Targeted, differentiated, easy to access	<ul style="list-style-type: none"> • There is a need to develop well targeted, clearly differentiated, and easy to access support schemes in support of business research and innovation. • The new BTYK decision aiming to secure integrity, coherence and target-oriented approach in R&D, innovation and entrepreneurship support mechanisms is an opportunity.
Responsiveness to firms' needs notably SMEs	<ul style="list-style-type: none"> • There exist support measures specific to SMEs. • There is a need to enrich the policy mix with support schemes tailored to the needs of companies, particularly SMEs.
International evaluation procedures	<ul style="list-style-type: none"> • There is a need to establish international evaluation procedures
Support to young innovative firms	<ul style="list-style-type: none"> • There exist support measures and increasing awareness on the need for specific support to young innovative companies • There is a need to enrich the policy mix with a range of measures supporting young innovative companies
10. Public sector driving innovation	
Innovative public sector and public services	<ul style="list-style-type: none"> • There exist pilot projects and activities to raise awareness on public sector innovation • There exist the 'Support Programme for Research Projects of Public Institutions' of TUBITAK for supporting R&D projects of public bodies • There is a need to develop policies and incentives to stimulate innovation in the public sector and in the delivery of public services
Innovation-oriented procurement	<ul style="list-style-type: none"> • There is a need to stimulate public procurement of innovative solutions to improve public services, including through dedicated budgets and joint procurement • The new BTYK decision aiming at improving public procurement and public right of use in such a way to foster innovation, localisation and technology transfer is an opportunity.
Access to government-owned data	<ul style="list-style-type: none"> • There is a need to have policies, a legal framework and procedures for making government-owned data freely available as a resource for innovation, where possible.

3.4 Assessment of the policy mix

Overall, the existing policy mix of measures in Turkey focuses on five main categories: (1) Increasing the R&D activities at universities, public research organisations and enterprises, (2) Intensifying R&D co-operation between public or higher education research organisations and enterprises, (3) Increasing the number of new R&D intensive enterprises and their survival, (4) Increasing the rate of commercialisation/marketing of the results of R&D activities by research and higher education organisations, and (5)

Developing human resources for research and technological innovation. Considering the categories covered by the existing policy measures, one can conclude that there are areas, which are not yet addressed by the existing policy mix. Policy measures to foster innovation in services, non-technological innovation, innovation in the public sector, innovative public procurement and technology transfer between firms are among the areas, which need to be better addressed by the existing policy actions. As noted above, the BTYK has recently approved strategies and taken decisions to design and implement new measures. These measures will help enriching the policy mix and help address an important number of these areas.

Another important aspect, which should be taken into account, is the regional and sectoral focus of the policy mix. Although given high priority at the moment, these two dimensions have not yet been considered in existing policy measures. It is an important opportunity for Turkey to promote R&D and innovation through specific schemes to be tailored both for traditional and medium to high-tech sectors. With the creation of the regional development agencies, R&D and innovation at regional level have recently started to gain importance. This development brings about a challenge for the governance system: to carefully and successfully orchestrate national and regional policies and policy actions to avoid overlaps.

As noted in previous sections, not all policy measures are regularly and systematically monitored and evaluated. However, the positive trends in R&D and innovation performance of Turkey, as explained in the previous sections, indicate that the current policy mix helps to address the key structural challenges. While this can be drawn as a general conclusion about the policy mix based on the current evidence, the evidence from various assessments and evaluations is that there is room for streamlining processes and improving implementation rules and regulations of on-going measures. There is also need to improve the process of designing and delivering research and innovation policy, with a view to develop a coherent and appropriate policy mix. For instance, actions need to be taken to enhance policy reviews of the overall policy mix and to assess the impacts of other policy or regulatory proposals on the R&D and innovation performance and potential of the country. It is also necessary to improve the design of measures by responding to the needs and requirements of the target groups.

Table 3: Policy measures and assessments

Challenges	Policy measures/actions ⁵³	Assessment in terms of appropriateness, efficiency and effectiveness
Promoting research commercialisation from universities	Industrial Thesis (SAN-TEZ) Projects Support Programme ‘Law of Technology Development Zones’ ‘Technology Transfer Support Programme for SMEs’	The ongoing measures have been instrumental in stimulating research commercialisation. With the implementation of the new decisions of the BTYK and the National Science, Technology and Innovation Strategy 2011-2016 it is expected that the policy mix will be enriched to address this challenge. Design and implementation of a variety of measures (financial, non-financial, etc.) to promote the whole range of routes for research commercialisation will be helpful.

⁵³ Changes in the legislation and other initiatives not necessarily related with funding are also included.

Challenges	Policy measures/actions ⁵³	Assessment in terms of appropriateness, efficiency and effectiveness
<p>Increasing the number of innovative high-growth start-ups</p>	<p>‘Technopreneurship Support Programme’</p> <p>‘Entrepreneurship Support Programme’</p> <p>‘R&D, Innovation and Industrial Application Support Programme’</p> <p>‘Support Programme for Technology- and Innovation-focused Entrepreneurship’</p>	<p>The existing measures are useful in stimulating start-up creation. However, the underdeveloped venture capital and business angels market, as well as limited number and variety of policy measures for start-up creation constitute an important barrier. The BTYK decisions of December 2011 recognise this challenge and aim to address it through policy measures to be developed. The new ‘Entrepreneurship Council’ is also expected to play a key role in the development of the business angel and venture capital market. A full range of additional measures is needed to address this challenge.</p>
<p>Increasing R&D and innovation capabilities of the private sector (in particular, micro, small and medium enterprises (MSMEs))</p>	<p>‘Support Programme for Industrial R&D Projects’</p> <p>‘R&D, Innovation and Industrial Application Support Programme’</p> <p>‘Technology Development Project Support’</p> <p>‘Law of Technology Development Zones’</p> <p>‘Law on Supporting Research and Development Activities’</p> <p>‘SME Funding Programme’</p> <p>‘Advanced Technology Project Supports (ITEP)’</p> <p>‘Technology Transfer Support Programme for SMEs’</p> <p>Industrial Thesis (SAN-TEZ) Projects Support Programme</p>	<p>While the existing measures listed here aim to increase R&D and innovation investments in the private sector, they do not focus on the need for developing absorptive capacities in firms. It is important to design and implement specific measures (such as support for R&D/innovation vouchers and knowledge intensive service activities, etc.) for enhancing the learning capabilities, absorptive capacity and R&D and innovation capabilities of MSMEs and other private sector companies.</p>

Challenges	Policy measures/actions ⁵³	Assessment in terms of appropriateness, efficiency and effectiveness
Focusing on sectors and thematic areas of importance	'Support Programme for Research Projects of Public Institutions'	The existing support programme focuses on defence, security and space research ⁵⁴ along with support to generic R&D projects. With the new National Science, Technology and Innovation Strategy 2011-2016, priority thematic areas were identified and strategies for three of them (energy, water and food) were developed and approved. It is expected that policy measures for these thematic areas will be developed and implemented. In addition to these developments, stimulating innovation in traditional sectors and addressing societal challenges such as climate change mitigation and health through specific measures can be considered.
Increasing investment in intellectual assets	'Programme to Encourage and Support Patent Applications' 'General Support Programme'	Existing programmes have helped increase awareness on the subject as well as growth in IPR applications. Current strategies and action plans indicate ongoing commitment in this area. Further efforts and diversified measures would be helpful to increase IP and the ability to create economic value from intellectual assets of firms and universities. The BTYK decision of December 2011 on stimulating domestic patent licensing supports the steps taken to tackle this challenge.

4 National policy and the European perspective

Considering the evolution of the Turkish research and innovation policy and the current policy direction it is possible to conclude that the policy mix will continue to become more innovation and entrepreneurship focused. Until the recent developments, the policies and strategies were based on a linear view of innovation, which is heavily focused on research. For the short and medium term, it is important that innovation is placed at the heart of the development and growth process, and is integrated and embedded in each policy area.

It is expected that the existing high-level commitment for achieving new targets set for 2023 will contribute to the enrichment of the policy mix with the design and implementation of new instruments. At this stage, it is also important to evaluate existing measures in terms of their complementarity, effectiveness, efficiency, impact, relevance, coherence and sustainability. In addition, it is foreseen that the funding allocated for different categories of policy measures are balanced and different types of funding, including venture capital, are made available for innovation activities.

With the new governance structure, it is expected that a more effective system will be created to coordinate research and innovation policy-making and implementation both vertically (between the different layers of the national innovation system) and

⁵⁴ <http://www.tubitak.gov.tr/sid/991/pid/547/index.htm>

horizontally (across the key actors -the ministries, government departments and implementing agencies). This process can be supported with further developing and improving competencies, capabilities and institutional capacities of the organisations in the system. Another important dimension in the short run is the creation of an innovation-friendly regulatory and legislative framework and environment (academic promotion, venture capital, exit markets, company formation, operation, dissolution, etc).

The process of the harmonisation of the EU *acquis* contributes to the above efforts, as it did so far. Although not a Member State yet, Turkey’s strategies and efforts in the field of S&T and innovation are, to a large extent, in line with the ERA pillars/objectives (see Annex for details). In addition, R&D objectives of Turkey are in parallel with the ERA targets. The ERA developments have been closely followed by the policy-makers and the BTYK launched the “Turkish Research Area” (TARAL) in 2004 with inspiration from the ERA. TARAL, a platform for public, private and NGO stakeholders to coordinate future R&D priorities and collaboration, is aimed to be integrated with the ERA. In this respect, Turkey participates in the common programmes and is determined to be involved in the initiatives carried out at the European level. Further improvement of policy coordination across policy levels and in the policy mix would contribute to the alignment with the ERA pillars.

Table 4: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA dimension	Main challenges at national level	Recent policy changes
1	Labour Market for Researchers	<ul style="list-style-type: none"> • Need to increase supply for science & engineering matching the market demand • -Need to increase attractiveness of working conditions for researchers and academic staff (from Turkey and abroad) 	<ul style="list-style-type: none"> • A comprehensive strategy for HRST was issued for 2011-2016 and intensive activities have been launched for the implementation of the strategy with stakeholders from the public and private sector organisations and civil society.
2	Cross-border cooperation	<ul style="list-style-type: none"> • Need to develop capabilities and provide hands-on coaching to research community and business sector to take part in cross border projects 	<ul style="list-style-type: none"> • A new S&T and innovation strategy document covering the period 2011-16 aims to create more output from existing research capacity and enhance needs-oriented research capacity which would also stimulate research collaborations at international level • High commitment for the participation in intergovernmental organisations and schemes, mainly at the EU level

	ERA dimension	Main challenges at national level	Recent policy changes
3	World class research infrastructures	<ul style="list-style-type: none"> • Need to develop world-class research infrastructures (including e-infrastructures) and ensure access to them 	<ul style="list-style-type: none"> • Increase in the public finance allocated to develop world-class research infrastructures • Increased efforts to benefit from existing infrastructures and to establish new ones
4	Research institutions	<ul style="list-style-type: none"> • Need to strengthen research institutions, including notably universities and need to focus on the third mission at universities 	<ul style="list-style-type: none"> • The new S&T and innovation strategy document aims to strengthen R&D infrastructure and capacities at universities • The new BTYK decisions put emphasis on third mission activities
5	Public-private partnerships	<ul style="list-style-type: none"> • Need to create new structures like knowledge transfer offices in line with the international good practices • Need to create incentives to increase the attractiveness of academia-business collaborations for academics 	<ul style="list-style-type: none"> • The new S&T and innovation strategy document focuses on creating mechanisms for technology transfer and collaborative R&D • The new BTYK decisions aim to promote research-private sector collaboration • The amendment in the 'Law of Technology Development Zones' adopted on 2 March 2011 requires technoparks to establish their technology transfer offices
6	Knowledge circulation across Europe	<ul style="list-style-type: none"> • Need to develop capabilities and provide hands-on coaching to research community and business sector to take part in international projects 	<ul style="list-style-type: none"> • Increased efforts to integrate TARAL with ERA • High commitment for the participation in intergovernmental organisations and schemes, mainly at the EU level
7	International Cooperation	<ul style="list-style-type: none"> • Need to develop capabilities and provide hands-on coaching to research community and business sector to take part in international projects 	<ul style="list-style-type: none"> • Increased efforts for enhanced international cooperation in S&T • Increased efforts to integrate TARAL with ERA

Annex: Alignment of national policies with ERA pillars / objectives

1. *Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers*

1.1 Supply of human resources for research

According to TURKSTAT (2010)⁵⁵ population statistics, 0.17% of Turkish population have PhD degrees, 0.55% holds masters degrees and 6.9% holds university degrees including the vocational high schools. (Here it should be noted that according to the results of 'Address Based Population Registration System' of TURKSTAT, 35% of the Turkish population was less than 20 years old in 2008, which means that 25 million of the population were under the university age.) As noted before, the number of R&D personnel increases with the increase in public funding. When the educational levels of FTE R&D personnel is considered, 23.1% of them holds a PhD or a higher degree, 18% holds a masters degree, and 40.9% holds a bachelors degree. The rest has either a post-secondary non-tertiary or a lower degree. While the holders of a PhD or a higher degree constitute almost half of the FTE R&D personnel employed in the higher education institutes, in the private sector, they make up for only 2.9% of the total R&D workforce (TURKSTAT, 2010).⁵⁶

According to the 'Careers of Doctorate Holders Survey' of TURKSTAT, employment rate of doctorate holders was 93% in 2009. The unemployment rate was 0.9% and the rate of inactive PhD holders was 6% in the same year. The highest share of PhD holders were employed by the higher education sector (72.7%) which is followed by the government sector (14.9%) and business sector (11.5%). According to the same survey, 14% of PhD holders stayed or lived abroad for more than three months for studying, working or carrying out research between January 2000 and December 2009. The most important reason for moving out was academic factors (33.1%). This was followed by family or personnel reasons (18.3%) and completion of advanced research qualifications (14.7%). The proportion of mobility intention of PhD holders within 12 months was 16.2%. The most important reason for this was academic factors (82.2%).

The number of support measures to stimulate inward and outward mobility has increased in the last decade. Germany and USA are the most popular destinations for tertiary education for Turkey. 38.2% and 18.2% of Turkish citizens enrolled in tertiary education institutions in Germany and USA, respectively. The Asian students account for the highest share of international tertiary students in Turkey (57.3%).⁵⁷ These

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http://rapor.tuik.gov.tr/reports/rwservlet?adnksdb2&ENVID=adnksdb2Env&report=wa_turkiye_cinsiyet_ya_sgrp_egitim_top.RDF&p_xkod=egitim_kod&p_yil=2010&p_dil=1&desformat=html

⁵⁶ http://www.tuik.gov.tr/PreHaberBultenleri.do?id=8623&tb_id=4

⁵⁷ www.oecd.org/dataoecd/61/2/48631582.pdf

measures are mainly implemented by the TUBITAK. Inward mobility programmes encourage both foreign researchers and Turkish scientists working abroad. The EU mobility programmes and networks (such as Marie Curie and EURAXESS) are also effectively used by Turkey.

1.2 Ensure that researchers across the EU benefit from open recruitment, adequate training, attractive career prospects and working conditions and barriers to cross-border mobility are removed

Tax incentives for R&D personnel working in technoparks and in 'R&D Centres', and other incentives like 30% bonus support provided by TUBITAK for the employment of PhD holders in its support programme for industrial R&D are important for increasing the attractiveness of researcher employment. As for the remuneration policies, salaries of academic staff at the public universities cannot be determined by universities and research institutes, while private universities are free in this respect. Average total annual salary of researchers in Turkey in terms of Purchasing Power Standard (PPS) was €26,250 (TL 52,800) in 2006 (European Commission, 2007)⁵⁸. This is almost half the EU-25 average of €40,126.

There is no evidence about the uptake of the European Charter for Researchers in Turkey, which sets the general principles and requirements that enable the frame for successful research performance, knowledge dissemination and technological development, and to the career development of researchers.

Making Turkey an attractive destination for international researchers is one of the priorities of the Science and Technology Human Resources Strategy and Action Plan 2011-2016. The studies on this area were started before the adoption of the strategy by the Science and Technology Human Resources Coordination Committee (STHRCC) and the International Researchers Coordination Committee (IRCC) (which were established by the BTYK in 2008). The latter has worked on regulatory issues for international researchers, i.e. work and residence permits, contract period, wage, retirement, academic promotion, education for researchers' children, learning Turkish, benefiting from health services, supports for scientific projects, and procedures for Turkish citizenship. The recommendations of this Committee were fed-back into the BTYK at its meeting in June 2009. The BTYK designated relevant bodies to adopt their regulations for the issues recommended by the Committee.⁵⁹

According to TUBITAK, some of the outputs of STHRCC and IRCC works on international researchers are as follows:

1. International researchers are privileged in obtaining Republic of Turkey citizenship;
2. They have gained the right for receiving Project Incentive Bonus (PIB) from TUBITAK projects;
3. They are provided with easy-access to information on work permits from the following webpage www.workpermit.gov.tr;

⁵⁸ <http://www.eui.eu/Documents/MWP/AcademicCareers/SalaryComparisonEUreport2007.pdf>

⁵⁹ <http://www.tubitak.gov.tr/sid/1009/pid/547/index.htm>

4. For those who are studying in universities and public research institutes for maximum two years and working in projects in the frame of EU Pre-accession programs work permit requirement was removed;
5. Actions were taken to complete duly applications for work permits in 30 days at the latest.

Also,

1. Researchers can get a preliminary permit not to exceed one year until they finalise their operations related to academic and professional qualification.
2. The process of recognition of diplomas and academic promotion is facilitated.
3. Improvement of researchers income has been achieved by removing revolving fund deductions.

Within the IRCC, a synergy was also created concerning the activities undertaken within the context of the EURAXESS Network. As the coordinator of the network in Turkey, TUBITAK launched the Turkish portal to which various authorities taking part in IRCC contributed with legal and procedural information.⁶⁰ As a member of EURAXESS research vacancies in Turkey are advertised on the European Researcher's Mobility Portal.

There are not any recruitment procedures in place that may hinder the openness of the vacancies towards non-nationals. Non-nationals are eligible for permanent research and academic positions. The only improvement required in the system is to ensure that the research grants portable.

1.3 Improve young people's scientific education and increase interest in research careers

In 2010, TUBITAK created the 'Advisory Board for Science and Technology Human Resources Strategy' to prepare the strategy and action plan for the development of S&T human resources. Based on the studies of the advisory board, the following decisions were taken by the BTYK in June 2010 in order to make sure that Turkey becomes a centre of attraction for S&T human resources:

1. Housing opportunities are to be increased for graduate students and young scientists;
2. The definitions for post-doc researcher and positions are to be made, and necessary legislative, financial and administrative regulations are developed jointly by the Ministry of Finance, the Higher Education Council and TUBITAK.

The Science and Technology Human Resources Strategy and Action Plan 2011-2016 - in addition to above items- includes a large number of action items for improving young people's scientific education and increase interest in research careers. The studies are underway to implement these actions which will ensure sufficient supply of science, technology, engineering and mathematics (post)graduates and an appropriate mix of skills among the population (including through strong vocational and education and training systems) in the medium-to-longer term.

⁶⁰ <http://www.tubitak.gov.tr/sid/1009/pid/547/index.htm>

In February 2011, the Law No. 6111 was issued to provide amnesty for undergraduate and graduate students including PhD candidates.

1.4 Promote equal treatment for women and men in research

In 2009, women researchers constituted 33.4% of total researchers, while the EU27 average was 30.2% in the same year. (EUROSTAT, 2009)⁶¹ According to the TURKSTAT (2010), the share of women researchers (full-time equivalent) is 22% in the business sector, 24% in the public sector and 41% in the higher education sector.⁶² The difference in salaries between men and women researchers was calculated to be around 28% in favour of male researchers (European Commission, 2007). Turkey is well situated in Europe with respect to female employment in research area. National regulations and laws allow the restoration back to the same type of work after career breaks (i.e. maternal leave). Additionally, every university with over a certain number of employments should establish a day care in their premises, which also encourages females to work as researchers.

2. Facilitate cross-border cooperation, enhance merit-based competition and increase European coordination and integration of research funding⁶³

Since Turkey is not an EU Member State, opening up national programmes has not been a policy consideration in the country. However, Turkey is represented by TUBITAK in the High Level Group on Joint Programming under European Research Area Committee (ERAC) and joint research projects are encouraged within the framework of bilateral S&T cooperation agreements with other countries. In addition, one of the horizontal axes of the National Science, Technology and Innovation Strategy 2011-2016 ('Activation of International S&T and innovation Cooperation in the Mutual Interests of Country') aims to address this objective.

3. Develop world-class research infrastructures (including e-infrastructures) and ensure access to them

One of the horizontal axes of the National Science, Technology and Innovation Strategy 2011-2016 is 'Boosting the Contribution of R&D Infrastructure to TARAL's Knowledge Production' aims to address this pillar. Improving research infrastructure (RI) is an important objective in the S&T and innovation strategies in Turkey. The Ministry of Development (MoD) promotes the establishment of research infrastructures under two

⁶¹ http://epp.eurostat.ec.europa.eu/portal/page/portal/science_technology_innovation/data/main_tables#

⁶² <http://www.tuik.gov.tr/ZipGetir.do?id=8623>

⁶³ Promote more critical mass and more strategic, focussed, efficient and effective European research via improved cooperation and coordination between public research funding authorities across Europe, including joint programming, jointly funded activities and common foresight.

- Ensure the development of research systems and programmes across the Union in a more simple and coherent manner.

Promote increased European-wide competition and access of cross-border projects to national projects funding

main headings: thematic advanced research centres and central research laboratories. The former is created by well-established universities to facilitate advanced research activities while the latter aims to build infrastructures for research in newly established and developing universities. The fields of activities of these centres include the following: Life sciences, engineering and material sciences, agro-food and veterinary, nanotechnology, ICT, defence and space, energy and environment and nuclear technologies. Research centre investments increased by around 350% from €60.12m (TL101m) in 2003 to €195.05m (TL453m) in 2011 (BTYK 23, 2011). The main reason for this remarkable growth is the increase in commitment in S&T, as explained before.

Turkey is a member of the ESFRI, and actively participates in the thematic working groups and in the EU Roadmap Working Groups (in the fields of Biological and Medical Sciences, Physical Sciences and Engineering, Environmental Sciences, and Social Sciences and Humanities). In addition, Turkey is a partner in the ESFRI projects such as the 'European Multidisciplinary Seafloor Observatory' and the 'Partnership for Advanced Computing in Europe', and is taking steps to participate in the 'Pan-European infrastructure for clinical trials and biotherapy'. Turkey does not commit funds for the implementation of the ESFRI Infrastructures⁶⁴.

Under the National Science, Technology and Innovation Strategy (2011-2016) the MoD planned a project in 2011 for the assessment of the current situation in research infrastructure, for conducting needs analysis and preparing a roadmap in line with the ESFRI. It also aims to develop a model for the organisation, finance and management of existing and new research centres.

In 2011, the MoD organised a workshop with the RI stakeholders and issued an inventory of RIs in Turkey. The ministry plans to complete in 2012 the administrative and legislative regulations on the subject. In addition, activities are implemented by various organisations under the national strategy for achieving coordination between organisations for the development and effective use of RIs in accordance with the national and local needs.⁶⁵

4. Strengthen research institutions, including notably universities

Academic freedom of the academic personnel and the scientific autonomy of the higher education institutions are protected by the Turkish Constitution, Article 130. In article 130, universities are defined as autonomous institutions having scientific freedom. The right of universities and that of academic personnel to freely conduct research and publish the results are protected by this article. This article also states that this right cannot be used against the existence and sovereignty of the State and the unity of the Nation and the State. The private universities enjoy financial and administrative autonomy in addition to academic freedom. The public universities, however, do not have financial and administrative autonomies. The organisational scheme of higher education institutions is defined by law. The public HEIs are subject to the same public finance laws as other public agencies. Hence, indirect governance of the state universities by the government and the lack of administrative and financial autonomy are

⁶⁴ ftp://ftp.cordis.europa.eu/pub/esfri/docs/esfri_roadmap_update_2008.pdf

⁶⁵ http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/btyk/23/BTYK23_Gelismeler.pdf

unavoidable unless a legislative change on these two issues are realised (European Commission, 2006).

As regards the quality assurance of HEIs, the 'Regulation for Academic Assessment and Quality Improvement at HEIs' was enacted on 20 September 2005. The regulation determines the principles of assessing and improving the quality of education and research activities and administrative services at HEIs, as well as the approval and recognition of their level of quality through an independent external assessment, which is conducted every five years. It also regulates the internal assessment of academic activities and administrative services of HEIs. Internal assessments are carried out annually since 2006.

With the new direction of the research and innovation policies in Turkey, which is becoming more innovation and entrepreneurship-focused, the discussions on the third mission of universities has increased. The BTYK decisions taken in December 2011 and the Entrepreneurship Council created in January 2012 aims to promote the third mission activities and establish a national monitoring/evaluation mechanism for the research and innovation performance in HEIs.

Block funding to the universities is not linked to scientific results (i.e. bibliometric indicators, patents, etc.).

5. Facilitate partnerships and productive interactions between research institutions and the private sector

As noted in the main report, facilitating partnerships and collaboration between research institutions and the private sector is a policy priority in Turkey (for example, the National Science, Technology and Innovation Strategy 2011-2016 aims to address these partnerships through 'Stimulating the Transformation of Research Results into Products and Services' and 'Diffusion of Multi-Actor and Multi-Discipline R&D Cooperation Culture') and there are a number of measures for this purpose. Some of these measures include the technology transfer support initiated by TUBITAK in 2011, the Law on Technology Development Zones and the Industrial Thesis Projects Programme.

IPR policies mainly focus on increasing the level of awareness on IPR in Turkey. In order to increase the number of patent applications a support programme is implemented by TUBITAK (the 'Programme to Encourage and Support Patent Applications').

The management of intellectual property in knowledge transfer activities does not yet fully follow the Code of Practice for universities and other PROs.

There exist no direct mobility schemes allowing S&E students/PhDs/researchers to conduct innovation projects in firms. On the other hand, the 'Industrial Thesis Projects Programme' of the MoSIT promotes university-industry interactions by co-financing research activities conducted by universities under thesis studies for a private sector company.

Although it attached importance in the new strategies, the current framework does not facilitate mobility between public and private institutes since there exist no legal basis and incentives designed for this purpose.

For the transfer of knowledge and technology, technology transfer offices are promoted in Turkey. With the 2011 amendment of the Law on Technology Development Zones, the technology development zones, which are located in and nearby a university/research centre, are required to establish their technology transfer offices. The new S&T and innovation strategies are also attach importance in the creation of technology transfer offices.

The private sector is not involved in the governance bodies of public universities while it is possible in private universities. PROs may have such involvements in their advisory boards.

6. Enhance knowledge circulation across Europe and beyond

The cross border knowledge circulation is considered in two-folds in the National Science, Technology and Innovation Strategy 2011-2016: International cooperation in STI and knowledge circulation via researchers' mobility. International cooperation is one of the six horizontal pillars of the strategy. In the 2011 action plan, 12 actions have been identified to boost the international mutually beneficial cooperation. In 2011, a report for prepared for Balkan countries. Studies will continue to analyse 40 countries participating in EU FP7.

TUBITAK has 28 bilateral cooperation programmes on science and technology with 25 countries. A total amount of €9.52m⁶⁶ (TL22.1m) was disbursed for 368 international projects under these agreements⁶⁷. The EU Member States with which Turkey have bilateral research agreements include the following: Bulgaria, Czech Republic, Germany, France, Greece, Hungary, Italy, Poland, Romania, Slovakia and Slovenia. TUBITAK has also signed co-operation agreements with Belarus, India, South Korea, Macedonia, Mongolia, Pakistan, China, Russian Federation, Syria, Tunisia, Ukraine, Singapore, Japan and the USA.

Under the 'International Industrial R&D Projects Support Programme', TUBITAK funds the Turkish partners in EUREKA projects (along with other international programmes). Total amount of funds allocated to the projects supported by this programme is approximately €5.36m (TL11.7m) by October 2011 since 2010 (BTYK23, 2011).

Turkey actively takes part in ERA-NETs under the Specific Programme "Cooperation", Specific Programme "Capacities" under FP6 and FP7. In addition, the meetings of the Networked and Electronic Media (NEM) and European Construction Technology Platform (ECTP) are participated by Turkish representatives.

Turkey is represented all five of the JTIs of EU: Innovative Medicines Initiative (IMI), Nanoelectronics Technologies 2020 (ENIAC) and Fuel Cells and Hydrogen (FCH), Aeronautics and Air Transport (Clean Sky) and Embedded Computing Systems (ARTEMIS).

Furthermore, Turkey actively participates in the FP7 Capacities Specific Programme International Cooperation Network (INCONET) projects. There are 17 projects, where international cooperation with third countries is built between the target country and EU.

⁶⁶ 1 €=2.32 TL

⁶⁷ http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/btyk/23/BTYK23_Gelismeler.pdf

Additionally, Turkey is the coordinator of the project Concert Japan, leading the EU-Japan cooperation in science and technology.

Inward mobility programmes encourage both foreign researchers and Turkish scientists working abroad. TUBITAK launched a programme 2010 to encourage the brain gain. Under this programme, scholarships are provided to the Turkish researchers who finalised his/her PhD studies and worked 2 years abroad at a job related to his/her area of expertise.

Turkey actively participates in international, mainly EU, mobility programmes and networks (such as Marie Curie and EURAXESS).

In addition, TUBITAK has the following programmes facilitating cross-border knowledge circulation via mobility:

- International Graduate Studies Fellowship Program
- International PhD Fellowship Program
- International Research Fellowship Program
- International Research Fellowship Program for PhD Students
- International Post-Doc Research Fellowship Program
- PhD Fellowships for Foreign Researchers
- Research Fellowships for Foreign Researchers
- Guest Researchers Support Program
- TUBITAK-DFG (Germany) Scientific Exchange Fellowship Program
- TUBITAK-HAS (Hungary) Scientific Exchange Fellowship Program
- Support Program for Participation to International Scientific Events

7. Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world

Turkey designed and implemented the 'International Science, Technology and Innovation Strategy' for the period of 2007-2010. The new National Science, Technology and Innovation Strategy (2011-2016) puts high emphasis on international cooperation and includes a wide range of actions on the subject (mainly under the 'Activating International S&T and Innovation Cooperation in the Mutual Interests of the Country' axis). As noted in above section, a large number of bilateral agreements exist with a wide range of countries. In 2011, for example, cooperation agreements were signed with the Poland and Ethiopia, and discussions were initiated for agreements with Azerbaijan, Benin, Brazil, Morocco, South Africa, Kenya, Colombia, Malaysia and Mexico, Peru, Tunisia, Turkmenistan, Sudan, Japan, Ecuador, Georgia (BTYK23, 2011).

International cooperation with the EU countries is given priority in the new S&T and innovation strategy. Also, international cooperation in the field of space research is one of the targets of the S&T policies. In 2011, agreement was reached with European

Space Agency to extend the framework contract and Turkey has become a member in the Asia-Pacific Space Cooperation Organisation.⁶⁸

In 2011, joint calls for proposals were opened with the German Federal Ministry of Education and Research (BMBF) and Korea Institute for Advancement of Technology (KIAT). 19 project proposals were submitted to TUBITAK in the period covered by the call. As of October 2011, total number of ongoing projects supported under bilateral agreements was 368 (BTYK23, 2011).

In 2011, TUBITAK started a new programme called 'Support Programme for International Collaboration Events' and eight events were supported with €21,529 (TL 50,000) as of 31 October 2011.⁶⁹

⁶⁸ http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/btyk/23/BTYK23_Gelismeler.pdf

⁶⁹ http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/btyk/23/BTYK23_Gelismeler.pdf

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List of Abbreviations

BERD	Business Expenditures for Research and Development
BMBF	German Federal Ministry of Education and Research
BTYK	Supreme Council of Science and Technology
ECTP	Scientific and Technical Research Committee
ENIAC	Nanoelectronics Technologies 2020
ERA	European Research Area
ERA	European Research Area
ERAC	European Research Area Committee
ERA-NET	European Research Area Network
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EU-27	European Union including 27 Member States
EUREKA	European Research Coordination Agency
FCH	Fuel Cells and Hydrogen
FDI	Foreign Direct Investments
FP	European Framework Programme for Research and Technology Development
FP7	7th Framework Programme
FTE	Full Time Equivalent
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
HRST	Human Resources for Science and Technology
ICT	Information and Communication Technology
INCONET	International Cooperation Network
IMI	Innovative Medicines Initiative
IPR	Intellectual Property Rights
IRCC	International Researchers Coordination Committee
ITEP	Advanced Technology Projects Support Programme
IUS	Innovation Union Scoreboard
KIAT	Korea Institute for Advancement of Technology
KOSGEB	Small and Medium Enterprises Development Organisation
MoD	Ministry of Development
MoE	Ministry of Economy
MoNE	Ministry of National Education
MoSIT	Ministry of Science, Industry and Technology

MSME	Micro, Small and Medium Enterprises
NEM	Networked and Electronic Media
NGO	Non-Governmental Organization
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
OSYM	Measurement, Selection and Placement Centre
PCT	Patent Cooperation Treaty
PIB	Project Incentive Bonus
PPS	Purchasing Power Standard
PRO	Public Research Organisation
R&D	Research and development
RDA	Regional Development Agency
RI	Research Infrastructures
S&T	Science and Technology
SME	Small and Medium Sized Enterprise
STHRCC	Science and Technology Human Resources Coordination Committee
TARAL	Turkish Research Area
TOBB	Union of Chambers and Commodity Exchanges of Turkey
TPE	Turkish Patent Institute
TSE	Turkish Standards Institute
TTGV	Technology Development Foundation of Turkey
TUBA	Turkish Academy of Sciences
TUBITAK	Scientific and Technological Scientific and Technological Research Council of Turkey
TURKAK	Turkish Statistical Institute
TURKSTAT	United Nations Conference on Trade and Development
UNCTAD	Coordination Council for the Improvement of Investment Environment
YOIKK	Higher Education Council
YOK	High Planning Council
YPK	Turkish Accreditation Agency