

CHAPTER 6. FOSTERING TECHNOLOGY ADOPTION, INNOVATION, AND SKILLS

6.1 Harnessing the knowledge factors—technology, innovation, quality and skills—is essential for increasing Turkey’s productivity and ensuring alignment with EU policies and strategies. Productivity improvements are driven by absorption of existing technologies, innovation, collaboration between firms and research centers, use of quality standards and the availability of a skilled labor force that can stimulate technology adoption and innovation.⁶⁰ Admitting that the knowledge factors are drivers for productivity and growth, the European Commission placed them at the core of its economic policy objectives by issuing a Green Paper on Innovation in 1995 and by setting as one of its key objectives at the 2000 Lisbon Council Summit “making the European Union the most competitive and dynamic knowledge-based economy by 2010.” The 2003 Innovation Communication identified specific challenges that candidate countries must address in the knowledge areas in order to improve the performance of the enlarged EU. These are addressed in several sections of the Acquis, including Chapter 25 on Science and Research; Chapter 7 on Intellectual Property Law; Chapters 1 and 4 on Free Movements of Goods and Capital; and Chapter 26 on Education.⁶¹ This CEM chapter highlights key challenges related to technology adoption, innovation, quality standards and skills in Turkey, both to meet Acquis requirements and, more broadly, to improve the country’s productivity, which is essential to accelerate long term economic growth and generate employment.

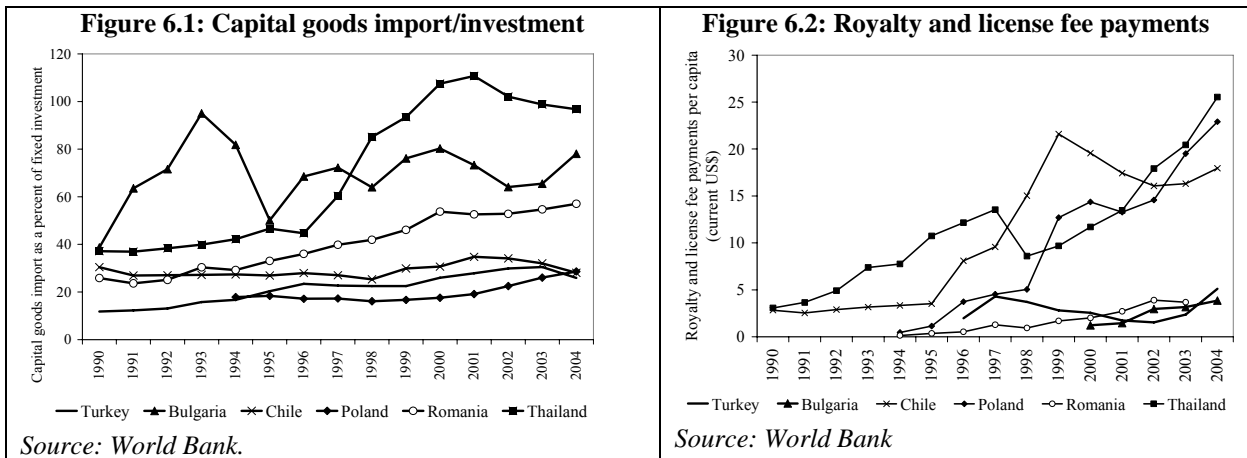
6.1. PROMOTING TECHNOLOGY ADOPTION AND INNOVATION AT THE FIRM LEVEL

6.2 *The three main avenues for acquiring existing technology in an open economy — foreign direct investment (FDI), licensing, and importing capital goods — are underutilized in Turkey.* As explained in chapter 1, FDI has boomed in 2005, to an estimated 2.6 percent of GDP, after having remained compressed at less than 1 percent of GDP in the 1990s, despite a worldwide increase by a factor of 12. For FDI to meet its potential as a means of absorbing technologies the increased observed in 2005 will have to be sustained in the future. Import of capital goods, a major absorption channel, is only 26 percent of total investment, about one third of the proportion in Bulgaria and one fourth of that in Thailand (Figure 6.1). Licensing is similarly weak at about US\$2 per

⁶⁰ For a detailed discussion of the impact of technology, innovation and skills on productivity, see *Closing the Gap in Technology and Education* (World Bank, 2003).

⁶¹ European Commission, Turkey 2005 Progress Report. November 9, 2005.

capita, one-tenth of the amount in Poland and comparable to the amount in Korea during the 1960s (Figure 6.2). Turkey has had, however, some success in specific industries. Multinational corporations have played a major role in developing the automotive sector, with high positive spill-over effects on the local economy. Licensing agreements, particularly in the automotive, automotive spare parts, and white goods sectors, have also led to an accumulation of know-how and the development of local technological capacities.⁶²



6.3 Turkey's progress on innovation, in terms of investments in R&D and patents filed by Turkish inventors, remains uneven. Both overall investment in R&D (GERD at 0.66 percent of GDP at the end of 2002) and the share of R&D financed by the private sector (41 percent of the total in 2002) have increased (Figure 6.3) and are in line with Turkey's level of development. The latest budget confirms that the government is moving in the right direction — funds allocated from the 2005 budget are higher than in all previous years. However, and notwithstanding recent initiatives to increase institutional capacity —including the creation of the Turkish Research Area (TARAL), which has as one of its key objectives that of increasing institutional capacity for innovation and supporting public-private cooperation in this area —more effort is needed to ensure that Turkey has coherent programs and capacity to utilize these resources effectively. Priorities for the future are improving firms' investment in R&D, a key determinant of a country's ability to ascend the technological ladder, and ensuring productive use of public R&D resources. The number of patents filed by Turkish innovators in the US, in the EU and at home is lower than for most comparator countries.⁶³ Protection of Intellectual Property Rights (IPR) has recently been improved through (among other initiatives) changes to the law on trademark protection to ensure compliance with other

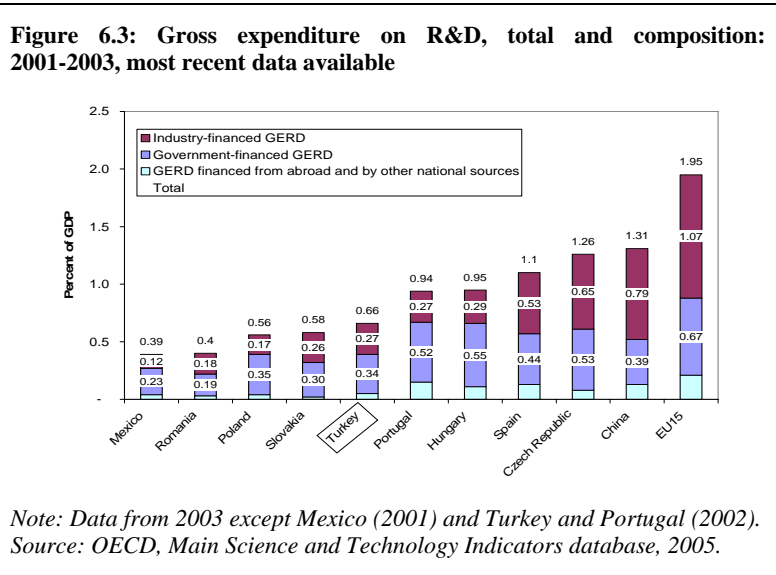
⁶² S. Elci, *Innovation and Technology* (background paper, 2005).

⁶³ Turkish inventors filed 0.4 and 0.9 patents in the US and the EU Patent Office respectively, versus 1.1 and 2.0 filed by Bulgarian inventors, and 3.9 and 8.2 filed by Czech inventors. Turkey also underperforms comparator countries in filing patent applications at home: 8 patents filed per million people, versus 39 in Bulgaria and 60 in the Czech Republic. US patent figures are from USPTO (2003), European figures are from the European Patent Office Annual Report (2004), and national patent figures are from WDI (2002).

Turkish laws and EU requirements, decrees related to protection of pharmaceutical and medical processes and products and biotechnological inventions, and administrative changes to the Turkish Patent Institute (TPE). In addition to these recent changes, further effort is needed to enhance both IPR legislation and IPR enforcement, in turn ensuring full compliance with *Acquis* requirements and fostering productive innovation.

6.4 Investments in innovation are promoted through tax incentives, matching grants and reimbursable loan schemes, while venture capital is almost nonexistent.

There are four main *fiscal provisions to support R&D* in Turkey. Turkish firms do not find tax postponement or support for R&D investment beneficial, and do not use these schemes. On the other hand, the incentives provided by the Technology Development Zone and R&D Tax Exemption Laws are very generous⁶⁴ and should be reviewed to assess their effectiveness, fiscal impact and consistency with the *Acquis*. Fiscal incentives often do not benefit SMEs, which have insufficient profits to use the tax benefits and do not record R&D expenses separately on financial statements, making them ineligible. TUBITAK-TIDEM, TTGV and KOSGEB offer matching grants and reimbursable loans for innovative initiatives. Before scaling up, it is important that the outcomes of existing and new programs be evaluated on the basis of international best practices. Finally, although Turkish legislation was modified in 2004 to promote venture capital investment, both supply- and demand-side factors still constrain the VC industry in Turkey.



6.5 Industry/research collaboration — a key condition for focusing research on productive purposes and stimulating technology adoption and innovation at the firm level — is limited. The main reasons are insufficient intermediaries, a lack of incentives to collaborate, perceptions that the quality of Turkish scientific institutions is low, and cultural differences between academia and business. The 2001 “Law on Technology

⁶⁴ For all firms: deduction of 40 percent of R&D expenditures from taxable corporate income, in addition to the ordinary Investment Tax Allowance (deduction of 40% of investment expenditures); for firms located in technology development zones: exemption from CIT for software development and R&D activities, as well as PIT-exemption for salaries of R&D personnel until the end of 2013.

Development Zones” provides incentives for firm-university collaboration by allowing private companies in technoparks to hire university researchers and researchers to start companies in the parks. However, these incentives are unavailable outside technoparks. In fact, researchers who provide services to firms not located in technoparks must transfer 70 percent of their income to their universities and cannot start their own businesses. This isolates scientists and researchers from the industrial world. Other initiatives to facilitate firm-research collaboration include TUBITAK-TIDEB’s University-Industry Joint Research Centres (USAMPs), KOSGEB’s Technology Development Centers targeting SMEs (TEKMERS) and TTGV’s technology development financing program, which helps create linkages between firms and the R&D community. In 2005, TUBITAK also initiated a National Public Research Program to encourage public agencies to establish partnerships with industry and academia, and an Industry Liaison Office in cooperation with the Chamber of Commerce (TOBB), aimed at training TOBB staff to intermediate between industry and TUBITAK. Despite the recent increase in technoparks, USAMPs and TEKMERs and more recent initiatives, the Turkish innovation infrastructure is not sufficient to jumpstart university-firm collaboration throughout the country.

6.6 *Policy and legal changes are needed to improve incentives for firm-level innovation and collaboration between researchers and firms, including extending to all universities incentives currently granted only to technoparks.* University researchers, excluding students, can benefit from their own research in Turkey — an innovative academician owns the related IPR and has the right to commercial revenues from patents the research generates. While this policy is satisfactory, additional measures are needed to: (a) extend the benefits currently provided to researchers working in technoparks to all universities by eliminating the rule requiring academicians working outside technoparks to transfer to universities 70 percent of their extramural income; (b) provide students with the same rights as researchers, because they may contribute to increasing productive innovation and patent levels in Turkey; and (c) create patent cost sharing schemes between inventors, universities and governments, and introduce clear rules about IPR ownership between researchers, research institutions and private firms.

6.7 *The industrial and intellectual property rights (IPR) legislation should be reviewed and IPR enforcement strengthened.* As mentioned above and indicated in the EU 2005 Report on Turkey’s Progress towards Accession, Turkey has already significantly improved its IPR regime. However, further progress is needed to ensure full alignment with the *Acquis* on both IPR *legislation* and *enforcement*.⁶⁵ The final legislation should be reviewed in collaboration with international experts and relevant stakeholders to ensure that it meets international requirements. Improving the IPR regime also requires strengthening of IPR enforcement. The most important measures are: increasing the autonomy of the Turkish Patent Institute (TPE) and further improving its staff’s capacity, knowledge and experience with registration and protection of IPR; further increasing the number of IPR courts and training programs for judges and prosecutors to ensure they can address the many IPR infringement cases; and limiting

⁶⁵ European Commission, Turkey 2005 Progress Report, Chapter Seven on Intellectual Property Law, pages 66-68. November 9, 2005.

piracy and counterfeiting by applying sanctions and improving border controls following the EC Directive on IPR enforcement.

6.8 ***Increase the number of intermediaries that can improve communication and collaboration among firms, universities and research centers in Turkey.*** Innovation intermediaries (technoparks, USAMPs, TEKMERs, and the recent Industry Liaison Officers) should be evaluated so only successful approaches will be replicated more broadly.⁶⁶ TUBITAK has recently started promoting public-private collaboration by requiring public agencies to establish consortia with universities and private firms in order to be eligible for funding, and by providing technical assistance and seed funds to young entrepreneurs. Successful international programs stimulating public-private collaboration which could be taken as a useful benchmark include the MAGNET program in Israel, TEKES in Finland and ATP in the US. The Spanish private-public Technology Innovation Centers (*Centros de Innovacione Tecnologicas, or CITEs*) may prove a beneficial model for promoting technology adoption among Turkish SMEs.

6.9 ***The design of the incentive system to increase finance for private R&D (i.e., fiscal incentives, matching grants and reimbursable loans) should be reviewed.*** The results of existing fiscal incentive schemes should be evaluated to assess their effectiveness, fiscal impact and consistency with the *Acquis*. Alternatives to fiscal incentives should be preferred for stimulating private R&D and innovation, particularly for SMEs. International best practice shows that well-designed matching grant schemes may be more beneficial in enhancing R&D investment and innovation. All matching grant and loan programs should periodically be assessed against international best practice, including the SPREAD program in India and, for matching grants, the experiences of Israel, Finland, Malaysia, Hong Kong, Chile and Mexico. Both TUBITAK and KOSGEB have started evaluating the results of their programs. External reviews could add value to the internal assessments by providing inputs based on lessons learned from international best practices. Finally, an overall support framework should be designed to: (a) replicate schemes with the highest impact on innovation, (b) assess and reduce overlap among providers, (c) increase collaboration between institutions and the funding ministries, and (d) reduce administrative hurdles in financing programs, which beneficiary firms say are a major drawback. The results of the agencies' recent efforts to streamline processes (e.g., TUBITAK's improvement in its TIDEB program including introduction of an advanced payment option in its R&D financing schemes) should be evaluated and complemented by similar initiatives aimed at streamlining administrative hurdles throughout the financial process.

6.10 ***Improving the effectiveness of the Turkish National Innovation System is important for conforming to EU policies and promoting innovation and technology absorption.*** An effective NIS is a prerequisite for successful technology adoption and innovation. Key measures to improve the Turkish NIS include: (a) reviewing the institutional capacity of TUBITAK to ensure alignment with international best practices;

⁶⁶ The Ministry of Industry and Trade is developing a monitoring and evaluation (M&E) system to assess the results of existing technoparks. The M&E system should be designed on the basis of international best practices.

(b) complement ongoing internal assessments of TUBITAK's programs and affiliate institutions (e.g., TUBITAK-TIDEM, MAM and UME), with external evaluations; (c) establishing regional policies, systems and infrastructure to support innovation and technology development at the local level;⁶⁷ and (d) ensure that the national innovation strategy places productive innovation at the heart of all science and technology policies by strengthening the role of the business sector in the innovation process and broadening the definition of innovation to include non-technological improvements (e.g., organizational and process changes).⁶⁸

6.2 IMPROVING THE NATIONAL QUALITY SYSTEM AND THE USE OF QUALITY STANDARDS

6.11 *Turkey has gone a long way towards establishing a modern quality standards regime, but further improvements are needed.*⁶⁹ Standards adoption enhances firms' capacity to export, absorb technologies and integrate with supply chains, in turn increasing productivity. Adoption of quality certification requires a well functioning National Quality Certification System (NQCS), comprehensive legislation and regulations, and sufficient accreditation and certification institutions. Turkey has replaced almost all national standards with EU and international standards and has a well functioning NQCS, comprising the Turkish Standard Institute (TSE), an accreditation agency (TÜRKAK) and a National Metrology Institute (UME). TÜRKAK, a full member of the European Cooperation for Accreditation, will soon be eligible for membership in the European Cooperation for Accreditation (EA-MLA), ensuring that its accreditations of Turkish notified bodies, its EC-type examination certificates and its conduct conformity assessments will be recognized in the EU. The transposition of harmonized European legislation into Turkish national legislation, as the first necessary step on the way towards full implementation of the legislation, is now nearing its completion. Public authorities are now at the stage of implementation of the transposed legislation. This requires, among other things, the establishment of a sound functioning market surveillance system with improved administrative and technical infrastructure.

6.12 *Legal and institutional changes are needed to further improve Turkey's National Quality System, coupled with provision of incentives to labs and firms to increase the use of quality standards.* First, it is in Turkey's interest to recognize tests

⁶⁷ On Turkey's overall need to improve decentralization, see EU 2005 Progress Report on *Acquis* Chapter 22 on Regional Policy and Coordination of Structural Instruments.

⁶⁸ While Turkey has developed several strategic plans to support innovation, they have focused on R&D and science policies. The main science and technology objectives adopted by BTYK in September 2004 – confirmed by BTYK's *Science and Technology Strategies Implementation Plan* for the period 2005-2010—are: increasing the share of GERD/GDP to 2 percent by 2010 (from 0.66 percent in 2002) and the number of full-time equivalent R&D personnel to 40,000 (from 28,964 in 2002), while increasing the number of vocational and technical staff proportionally. These are important objectives, but the strategy needs a clearer focus on productive innovation and technology adoption at the firm level and a stronger emphasis on output (rather than input) measures.

⁶⁹ B. Kaminski, *Technical Standards Regime and Trade* (background note, 2005)

and standards for products originating in countries with which the EU has signed mutual recognition agreements (MRAs),⁷⁰ It is also in Turkey's interest to obtain similar recognition for its products from the same countries. This would reduce the cost of imports by increasing competitive pressures on preferential (i.e., free trade agreement) exporters to Turkey and Turkey's quality standards. Second, some sector specific legislation should be aligned with the *Acquis* requirements (including for pharmaceuticals, cosmetics and chemicals), while food safety and foodstuff legislation should be adopted. Third, it is important to complete the process leading to TURTAK's international recognition. Fourth, TSE's responsibilities and functions should be compared with those of similar institutions operating in other countries. Fourth, there is a need to update the quality management system regarding standardization and development of a business plan on standardization work.⁷¹ Fifth, the government should encourage creation of private secondary metrology facilities to ensure national coverage. Finally, it is essential to increase Turkish labs' and firms' requests for accreditation and certification. Matching grants have proven successful at encouraging adoption of quality standards in several countries.

6.3. ALIGNING THE SKILLS OF THE LABOR FORCE WITH THE NEEDS OF THE PRIVATE SECTOR

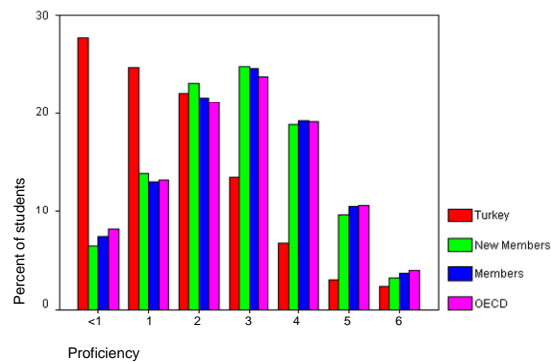
6.13 *Weak educational attainment is a bottleneck for widespread adoption of advanced technology and innovation.* Turkish pupils do not acquire key skills for the knowledge-driven economy (e.g., problem solving, stating relationships between events, making complex inferences, creativity and continuous learning), leaving them out of sync with the needs of the private sector. Fifty-five percent of Turkey's 15-year-olds perform at the lowest level on the PISA assessment of mathematics-quantitative proficiency, whereas the average in OECD countries is less than 21 percent (Figure 6.4). Similar results are found in reading literacy. Universities' traditional academic curricula do not reflect the needs of the private sector. Partially as a result of this, unemployment among recent university graduates is high. Turkey's vocational schools, both secondary and post-secondary, also provide insufficient quality education and training. This is particularly worrisome because employers in Turkey face a shortage of mid-tier, technician level workers.⁷²

⁷⁰ These countries include Australia, Canada, Israel, Japan, New Zealand, Switzerland and the United States.

⁷¹ EU 2005 Turkey Progress Report, page 56.

⁷² For a full analysis of education in Turkey, see the *Turkey Education Sector Study* (World Bank, 2005).

Figure 6.4: Distribution of students by PISA proficiency level in Turkey and EU, 2003



Source: Education Sector Study, The World Bank, 2005

6.14 *Improving the skills of the labor force and ensuring that they match the needs of the private sector requires rethinking the education system at all levels.*⁷³ It is essential that Turkey continues to reform and modernize primary and secondary school curriculum and teaching, as well as the structure of secondary education, to ensure that all Turkish students can acquire the skills that are needed by the labor market today and can serve as a foundation for lifelong learning in the future, including skills in problem solving, creative thinking, and communication.⁷⁴ Reforms are also needed to encourage tertiary education institutions to differentiate their missions and strategies, with a different balance of effort across the functions of teaching, research and service provision, so as to provide more viable and desirable options for graduates of high school interested in pursuing postsecondary studies. The admissions system for tertiary education should also be modernized to provide incentives for all young people (both in vocational and general secondary schools) to study and learn the core competencies needed to have successful careers in a globally competitive labor market. There is a need to consolidate and refocus post-secondary vocational schools (MYOs) into fewer, more efficient, and higher quality institutions with their own budgets and missions, while maintaining the academic link to universities. Turkey should also consider using its funding of postsecondary education to upgrade MYOs into technical colleges or polytechnic institutions granting two- to four-year degrees in a broad variety of areas so as to more flexibly provide high end technical skills to its graduates, in line with labor market demands. Finally, more emphasis should be given to cultivating lifelong learning systems for continuously upgrading human capital and to promoting continuing vocational training.⁷⁵ This can be accomplished by providing incentives to firms to both hire technical personnel and provide relevant training.

⁷³ See the *Turkey Education Sector Study* (World Bank, 2005).

⁷⁴ The Government hopes to address these quality constraints by means of a comprehensive program of curriculum modernization that it launched in 2004 to improve teaching and learning across all of the core subject areas.

⁷⁵ On the importance of lifelong learning, see also the EU 2005 Turkey Progress Report, page 118.