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Erkan Erdil
TEKPOL-STPS, METU, Science and Technology Policy Studies, Middle East Technical University, MM Binasi, 06531 Ankara, Turkey

Cédric Gossart
Institut TELECOM, TELECOM & Management SudParis, ETOS/CEMANTIC, 9 rue Charles Fourier 91011 Evry, France.

TEKPOL | Science and Technology Policies Research Center
Middle East Technical University
Ankara 06531 Turkey
http://www.stps.metu.edu.tr

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Erkan Erdil[a], Cédric Gossart[b*]

[a] TEKPOL-STPS, METU, Science and Technology Policy Studies, Middle East Technical University, MM Binasi, 06531 Ankara, Turkey.
[b] Institut TELECOM, TELECOM & Management SudParis, ETOS/CEMANTIC, 9 rue Charles Fourier 91011 Evry, France.
[*] Corresponding author: Tel.: +33 1 60 76 46 69; Fax: +33 1 60 76 42 86.
E-mail addresses: erdil@metu.edu.tr (E. Erdil), Cedric.Gossart@it-sudparis.eu (C. Gossart).

Abstract

This paper presents the results of a study investigating how sustainable development can be integrated in Turkish science and technology policies. It contributes to the elaboration of the national sustainable development strategy and to the implementation of the EU *acquis*. The project's originality for Turkey lies in its methodology (a participatory approach), and in its topic since sustainable development integration has never been dealt with in Turkey. Suggestions to improve this integration include strengthening the links between S&T institutions by entrusting the State Planning Organisation with the sustainable development integration mission, and raising awareness about its win-win advantages.

Keywords: Science and technology policy; Sustainable development integration; Participatory public policy; Environment; Turkey

1. Introduction

This paper presents the results of a study investigating how sustainable development can be integrated in Turkish science and technology (S&T) policies.[1] It contributes to the elaboration of the national sustainable development strategy and to the implementation of the EU *acquis* required for Turkey to become and EU member state. The project's originality is twofold. At first, its methodology adopted a participatory policy-making approach, which has seldom been used in Turkey. Second, since the topic of sustainable development is rather new in

[1] See http://www.undp.org.tr/Gozlem2.aspx?WebSayfaNo=98.

Turkey, the one of sustainable development integration issues an even greater challenge, but a promising one considering the positive outcomes of the project.

The significance of science and technology policies is quite different from other sectoral policies. Since S&T policies are umbrella policies and use a wide range of policy mix instruments, the integration of sustainable development into S&T policies is likely to produce significant spillover effects. This characteristic of S&T policies makes sustainable development policy integration more effective. Benefits of sustainable development integration in S&T policies include the diffusion of 'greener technologies' and the reduction of social inequalities. In the case of greener technologies, Montalvo and Kemp (2008) underline that they offer multiple benefits for the adopter such as reduced emissions, less waste and cost savings. In their study on Finland, Kivimaa and Mickwitz (2006) bring forward the key role of environmental policy integration in supporting the diffusion of environmental technologies. In developing countries, a major obstacle to this diffusion is the fact that sustainable development is perceived as a rich-country policy target, notably because "the cost of the environmentally conscious business practices is still considered as an obstacle" (Yüksel, 2008). To support the diffusion of cleaner technologies, public policies are paramount. As Luken and Van Rompaey (2008) put it, including in developing countries "environmental regulation and market pressure appear to exert more influence than community pressure on the adoption of environmentally sound technology". Integrating participatory approaches in S&T policies is key to the success of these policies. For example, Calleja and Delgado (2008) stress the positive role of involving industry and relevant stakeholders in the development of the European Environmental Technology Action Plan.

The issue at stake when integrating sustainable development in sectoral policies is a change in development paradigm. According to Smith et al. (2005: 1496), measures to promote civic debate facilitate the emergence of alternative 'visions' of the future. For example, public debates over genetically modified foods in the EU led to the organisation of informed debates allowing the participation of stakeholders' in policy agenda-setting and in technical and environmental education initiatives.

The other specificity of this paper is that it focuses on a developing country, which is moreover constrained by the European integration roadmap. Several studies such as the one by Kivimaa and Mickwitz (2006) have been carried out in developed economies about how to integrate non-economic sustainable development dimensions in socioeconomic sectors. Unfortunately, the prescriptions written for developed economies may not function well in developing countries. The case study on which this paper is based has used a participatory

approach to examine how to integrate sustainable development in Turkish sectoral policies. Thus, its findings are to some extent more relevant for developing countries, which are barely studied in the sustainable development integration literature.

The paper is organized as follows: Section 2 outlines the main features of the Turkish S&T sector and policies. We first present indicators on the S&T sector such as competitiveness index, GERD intensity, R&D human capital, patents and scientific publications. For the analysis of the S&T policies, the Republican era will be divided into four periods, each of which having different peculiarities and policies. Section 3 focuses on the challenge of integrating sustainable development in S&T policies. Following a methodological discussion, the Turkish case is examined and the recent project entitled "Integration of sustainable development into sectoral policies" is reviewed. With reference to three different phases of the S&T sector, namely S&T inputs, S&T activities and S&T outputs, problem areas and causes identified by the stakeholders involved in the project's participatory policy making process are presented. Section 4 describes the policy recommendations suggested by the latter participants, and Section 5 analyses the main policy options together with the limitations of the study as well as suggestions for future research.

2. Turkish S&T and sustainable development policies in retrospect

The S&T sector in Turkey has experienced a prolonged period of instability, especially until 2003. The non-existence of sector-specific polices for a long time period is the underlying cause of this instability. Besides others, the political and macroeconomic instability are the principal problem areas. The impact of macroeconomic instability on the sector operates through two channels, namely demand and supply-driven channels. While governments were unable to allocate necessary funds to the sector because of economic structural problems, the private sector did not demand too much from the S&T sector because of market uncertainties and their associated high costs. From an economic point of view, the share of R&D expenditures out of GDP is far below EU average. The composition of R&D expenditures is also problematic, in the sense that the share of the private sector is relatively lower than what it is in the most competitive economies (OECD, 2007). However, the picture seems to change radically after 2003. The macroeconomic stability achieved in Turkey after 2003 had significant reflections on the sector. As we will discuss later, major steps were taken forward to improve the performance of the S&T sector, and a relative improvement in the sectors' indicators was achieved between 2003 and 2007. The history of the Turkish S&T sector reveals that social and especially environmental issues have been largely neglected, although

there have been positive side effects of science-driven economic growth. The recurring problem of the Turkish S&T sector is the weakness of its institutions, which has created problems of governance of the sector. In this section, we first introduce the Turkish S&T sector; then we present key phases of Turkish S&T policies and analyse how they can contribute to the social and environmental dimensions of sustainable development.

2.1 The Turkish S&T sector

One of the main performance indicators for S&T sector on a society's welfare is the economy's competitiveness in the world markets. The competitive performance of an economy, of course, depends on other factors as well yet the above average performance in the S&T sector is decisive for the success in global markets. One of the widely used indicators in the literature is the Global Competitiveness Index (GCI), which includes not only economic indicators but also institutional and social indicators. According to GCI (2006), Turkey ranks 59th. As compared to new EU members and candidate countries, the overall picture suggests that Turkey performs well in terms of entrepreneurship indicators. However, she suffers from major shortcomings regarding key determinants of competitiveness, such as macroeconomic stability, education, and health.

According to OECD (2007) data on the S&T sector, both the EU (1.81%) and Turkey (0.79%) are far from reaching their predetermined target levels of GERD intensity (respectively 3% and 2%). However, the GERD intensity in Turkey exhibits a significant upward trend after 2002, and reaches a historical peak in 2005, when more than 40% of Turkish GERD was financed by industry and 50% by government. The main economic problem of the S&T sector was the low levels of participation of private domestic and foreign companies in the financing of R&D. In terms of the source of the performance of R&D, Turkey has the highest figure. The distribution of this performance reveals that government and industrial sectors are far behind higher education institutions. This corroborates findings suggesting that public-private partnerships and academia-industry relationships are not well-functioning in Turkey.

With respect to R&D human capital, Turkey's performance in terms of total researchers per thousand total employment is not promising. By the end of 2005, Turkey (1.80) was only outperforming China (1.5), South Africa (1.6), and Mexico (1.2). However, the growth rate of 20% in the period 2003-2005 demonstrates a potential for future growth in R&D personnel. Looking at total full-time equivalent researchers, Turkey has significantly less researchers compared to other countries having a similar level of development and a comparable

population. However, the situation is improving since Turkey has almost reached her 2010 target of 40 000 full-time equivalent researchers (TÜBİTAK, 2004).

Regarding the distribution of triadic patent families, the figures for Turkey are low, with again an upward trend in the past few years. Moreover, national applications to the Turkish Patent Institute have increased by some 115% between 2003 and 2006. The recently established support for national and international patent applications thanks to collaboration between the Turkish Patent Institute and TÜBİTAK is likely to accelerate this growth rate.[2] The indicator measuring scientific publications per million inhabitants is among the most promising ones for Turkey. Although Turkey's share is around 1.5% in the OECD area, in the last five years, with a growth rate of 141% Turkey reaches the highest rate in the world. This success has notably been achieved thanks to the integration in the evaluation of researchers of criteria based on SSCI publications.[3]

2.2 A Snapshot on Turkish S&T Policies

Turkish science and technology policy has gone through many stages and seen many actions undertaken during the Republican era. We chose to divide the history of Turkish science and technology policy into four periods.

1923-1960: Reconstruction. Under the conditions of extreme poverty in the post-war period, the first Republican government implemented economic reforms aiming at rapid industrialisation. The main policy tool used during this period is the transfer of technology, mainly from neighbouring countries. The employment of foreign scientists in Turkish universities, especially German-Jewish ones, was an important milestone from 1933 onwards. This has strongly contributed to build solid basic research capabilities in Turkish universities. The legislation enacted in 1951 and 1954 aiming to encourage foreign direct investments acted as leverage for industrial development. This period witnessed important developments, especially in the chemical industry. At this stage, Turkish S&T policies amounted to agricultural and industrial policies, and the institutionalisation of S&T policies had not started yet.

1960-1980: Plan period and crises. The strategic choice of planning as a public policy instrument shapes the period that has led to the establishment of the State Planning Organization (DPT) in 1961. The aim is twofold: the efficient use of resources, and the rapid development of the country. An import-substitution strategy was then driving Turkish

[2] For detailed information about this scheme, see http://www.tubitak.gov.tr/home.do?sid=371&pid=364.
[3] About the limits of such a policy for Turkey, see Gossart and Özman (2008).

economic policy. In this period, the historical development of Turkish S&T policies can be examined through DPT's Five Year Development Plans. During the first Five Year Development Plan (1963-1967), the most important event was the foundation of the Scientific and Technological Research Council of Turkey (TÜBİTAK) in 1963, aiming to support basic and applied research (Official Gazette, 1963). During the years following its foundation, TÜBİTAK was successful in supporting Turkish S&T policies. As the top public R&D institution, it monitored and evaluated the scientific and technological advance of the country, and supported and funded both public and private R&D activities. The first important development towards a "Turkish Science and Technology Policy" appears in the Fourth Five Year Development Plan (1979-1983). The "Technology Policy" concept was, for the first time in the history of Turkish S&T policy, intentionally used. Moreover, this plan scheduled the preparation of the report "Turkish Science Policy: 1983-2003", one of the most important steps in the history of Turkish S&T policy.

1983-2000: Export-led growth and crises. The report "Turkish Science Policy: 1983-2003" pictured out two key paths: the support of the R&D infrastructure and the identification of long-term scientific priority areas. The most fruitful result of this report was the foundation of Supreme Council of Science and Technology (BTYK). Aiming to develop, implement, elaborate, coordinate and direct the scientific and technological R&D policies of Turkey, it was chaired by the Prime Minister and was to convene twice a year although it seldom did until recently. Unfortunately, being a principal S&T policy-making institution, the BTYK has not functioned effectively up to the beginning of the new millennium. For the first time, the Fifth Five Year Development Plan (1985-1989) contained a section on "Science-Research-Technology", stating that R&D and technological development were guiding and impulsive forces of economic change and development (DPT, 1984). The 1990s were a dynamic period for the Turkish S&T policy, as far as the legislative and institutional issues are concerned. In the "Targets" section of the "Science, R&D and Technology" chapter of the Sixth Five Year Development Plan (1990-1994), major science and technology indicators were mentioned for the first time, and precise targets were set for them. Later, the most important event of the Seventh Five Year Development Plan (1996-2000) was the launch of "The Project for Impetus in Science and Technology". Within the scope of this project, new targets for S&T indicators were set, and specific fields of investment were proposed. Another vital theme of this Plan was the request to encourage the establishment of venture capital funds.

2000 onwards: A new approach and a challenging way to join the EU. The first couple of years of the 2000 decade witnessed important S&T initiatives. However, the vicious cycle of

the 2001 and 2002 crises may have significantly impeded the voluntary approach taken by the sector. However, in the post-crisis period, more hopeful and significant improvements were observed in the policy arena. First of all, the government eventually endorsed the political responsibility of S&T policies, and the BTYK started operating properly. The construction of a national innovation system and attempts to create regional innovation systems were key initiatives. Other measures of the Eighth Five Year Development Plan (2001-2005) included setting up technoparks and technological development zones to foster university-industry collaboration, increasing the support for SMEs' R&D activities, establishing new technology start-up companies, directing R&D activities to new technologies, and setting new targets for science and technology indicators (DPT, 2000). The promulgation of "The Law of Technology Development Zones" in 2001 was a significant step for R&D activities of SMEs in the context of university-industry collaboration.

The political attempts towards joining the EU also produced vital results for the Turkish S&T sector. Turkey has shown its intention to be a partner of European Research Area. The eighth meeting of the BTYK clearly exhibited this attempt to fully participate in the 6th Framework Program and subsequent ones. The sixth BTYK meeting took important decisions and produced the "National Science and Technology Policies: 2003-2023" strategy document. This document was used as an outline for the first Turkish S&T foresight study entitled "Vision 2023: Science and Technology Strategies" (BTYK, 2000, 2002). In 2004, in order to implement Vision 2023, BTYK entrusted TÜBİTAK to prepare a mid-term plan, called the "National Science and Technology Policies Implementation Plan 2005-2010". In the following BTYK meetings, social goals were taken into consideration but not environmental ones, which are nevertheless integrated in the 7th Framework Programme in which Turkey participates and finances.

In the next section, we explain the meaning of sustainable development integration and how it can be carried out in Turkey.

3. The challenge of integrating sustainable development in S&T policies

Sustainable development is a normative concept by which a society defines its development path. The term 'sustainable' has been added to the term 'development' because the latter was too much focused on the growth of national production measured with the GDP indicator, which misses out many (positive and negative) important aspects of the development process. Since the 1995 United Nations Commission on Sustainable Development, sustainable development encompasses four dimensions (economic, social, environmental, and

institutional).[4] Therefore, a sectoral policy such as the S&T one is sustainable if it integrates these four dimensions.

3.1 Sustainable development integration

Integrating sustainable development in sectoral policies allows them to anticipate the imbalance between the dimensions of sustainable development. For example, by demanding scientists to assess the risks of their research on humans or natural ecosystems, policy makers limit these risks ex ante. As explained in the next section, S&T policies tend to be associated with the support to innovation to boost economic growth, and thus with the economic dimension of sustainable development. Especially with the laws enacted in Europe at the end of the 19th century limiting child labour and granting basic rights to workers, and with the construction of welfare states in the second half of the 20th century, development policies took a greater account of social issues. As for the environmental dimension, only in the 1970s with an increased public awareness of ecological crises did governments start to integrate environmental issues in their policies. Finally, the institutional dimension covers the formal and informal institutions used by our societies to function. Formal institutions include rules or organisations, informal institutions are more tacit and less codified or tangible, and include cultural habits or representations. Some argue that cultural diversity is as important for the survival of human beings as biological diversity is. An important aspect of the functioning of formal institutions for sustainable development is their adoption of a participatory decision making process. Let us examine in greater detail what it means to integrate each dimension of sustainable development in S&T policies.

Sustainable development dimensions are integrated in S&T policies if the latter address the objectives of these dimensions, especially the ones of the 'forgotten' dimensions of development, the social and the environmental ones. This is a great challenge in itself given the heterogeneity of the forces behind each dimension. For example, the objectives of the economic dimension are defended by powerful actors. Social objectives are defended by unions who have difficulties in making their demands become reality through the policy making process. They are supported in their work by public authorities, whose role is to defend the general good. Under these conditions, it is not easy for environmental objectives to emerge on the political agenda. Another challenge of sustainable development integration lies in the fact that sustainable development is a normative concept by which societies decide to

[4] See http://www.foeeurope.org/sustainability/sustain/t-content-prism.htm.

change their way of life. The balance between the dimensions of sustainable development is a compromise resulting from the game of the policy making process in which all the actors of society play a part. In this game, the role of politicians is to implement a political programme aiming to meet citizens' needs such as having a job or living in a secure and clean environment. The integration of sustainable development dimensions in these programmes is thus highly dependent on people's preferences, which tend to be driven by what can be termed "presentism", namely the immediate satisfaction of one's individual needs. If what matters for the citizens of a country is the immediate satisfaction of their desires, even at the expense of the destruction of natural ecosystems for example, then we have a situation in which a democratic choice causes imbalance between sustainable development dimensions. This is currently the case in most countries in the world. Besides, the priority of all politicians being to be (re)elected, few of them would risk offering measures challenging the presentism of their fellow citizens. Especially since within consumer societies there are huge forces exerted on citizens to take presentism as a primary source of happiness, as opposed for example to the contribution to the common good. A government that is courageous enough to challenge this presentism, even if it is for the sake of capturing the political niche of "green electors", would need to integrate sustainable development in its policies. We will now briefly explain what this integration means for each dimension of sustainable development, and then what it implies for S&T policies.

Integrating sustainable development in a policy means that this policy makes the goals of the dimension hers.

Table 1

Key goals of each sustainable development dimension

Sustainable development dimension	Objectives
Economic *(Lisbon strategy)*	• GDP growth • Export growth • Zero inflation • Competitiveness • Full employment
Social *(EU sustainable development strategy)*	• Employment • Public health • Social inclusion • Global partnership • Demographic changes
Environmental *(EU 2010 environmental strategy)*	• Climate change & global warming • Natural habitat & wildlife • Health & other environmental impacts • Natural resources & waste management
Institutional	• Cultural diversity • Ethical concerns • Participation • Transparency

Once these goals have been integrated in the policy, instruments are identified to achieve them, and indicators chosen to monitor progress. Of course these goals are linked to each other. For example if social goals are not integrated in economic policies, labour productivity might be low. But if environmental goals are not integrated in economic policies, the negative consequences on economic goals may not be immediate or noticed at all, for example until biodiversity dramatically drops, or until radical climate changes occur. This is due to the fact that there is a general low level of awareness about the contributions of natural ecosystems to societies are largely ignored, such as the four contributions (life support services, resources, amenities, waste sinks) brought to the fore by Common & Stagl (2006: 87).

In the EU, since the Cardiff European Council that took place in June 1998, member states are invited to identify indicators to monitor the integration of environmental issues in non-environmental policy sectors, such as the S&T sector.[5] Sustainable development integration is a preventive approach ensuring that social and environmental goals are taken into account by all policies, so that they are not biased in favour of economic growth. The magnitude of this

[5] See http://www.europarl.europa.eu/summits/car2_en.htm. Based on a Communication from the Commission accessible at http://europa.eu/scadplus/leg/en/lvb/l28075.htm.

challenge is underlined by the Finnish Ministry for Foreign Affairs (2004: 20) in the case of one of the most advanced European countries:[6]

> "The greatest challenges in integrating sustainable development in Finland will be found from the cross-sectoral, multidimensional policy areas where joint action and common goals from different administrative branches are required."

According to CEPAL (2003: 12), the challenge posed to the S&T sector by sustainable development lies in a growing connectivity and interdependency at many levels (chaotic societal and ecological events become more likely), in changes in our understanding of the world (thanks to scientific discoveries), and in changes in the nature of public and private decision-making (more participation of citizens in decisions affecting them). These challenges are all the more acute in a developing country like Turkey.

3.2 Sustainable development integration in Turkish S&T policies

In Turkey, several policy initiatives have recently dealt with sustainable development issues. A first local Agenda 21 was drafted in 1997, a national environmental action plan was released in 1998,[7] and a national sustainable development report published in 2002. But although some of these initiatives mention the need to integrate sustainable development in sectoral policies (DPT development plans), none of them has dealt with the issue of integrating sustainable development into S&T policies. This lack of initiatives is evidenced for the policy area by the chapter 35 of the UNDP report on Turkey for the Johannesburg submit entitled "Science for sustainable development", which gave the lowest grade in terms of the quality of available information.[8]

With its 6th development plan (1990-1994), the DPT started integrating sustainable development in its development plans. The 8th plan (2001-2005) insisted on the need to integrate sustainable development in other policies, to adopt a participatory approach, to assess risks, to develop environmental technologies, and to carry out systematic environmental impact assessments (EIAs), following the 1993 by-law on EIA.[9] However, the

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[6] About the challenges faced by new member states, see the 2004 report of the Czech State Environmental Policy and the National Strategy for Sustainable Development published by http://www.ecn.cz/iep and available at http://www.kraj-lbc.cz/public/orlk/projectdocument_sur_lk_czech_final_for_undp_866acc2c32.rtf.

[7] Turkey has a National Environmental Action Plan (NEAP) for the years 1996-2000. It is a binding document for the public sector and serves as a guidance document for the private sector. In addition, certain sectors such as tourism, industry, energy, transport, and agriculture are working towards integration.

[8] See http://europeandcis.undp.org/WaterWiki/images/8/86/TurkeyCP.pdf, p. 71.

[9] Official Gazette N°25318. See http://www.abgs.gov.tr/tarama/screening_files/27/SC27DET_01.04.EIA.pdf.

enforcement of the transposed EIA directive is questionable. According to the 2006 accession progress report, regarding EIA Turkey was still excluding transboundary consultation requirements. Some activities, such as mining, are exempted from EIA, and public consultation needed improvement. Turkey has not yet become a party to the Espoo or the Aarhus Conventions (respectively on EIA and Right to environmental information), and no timetable is available with respect to joining these conventions. The strategic environmental assessment directive remains to be transposed. The government adopted in February 2006 a regulation which introduces regulatory impact assessments (RIA) in the Turkish legal system.[10] This suggests that due to the transposed RIA directive, any new S&T project should integrate environmental and health issues. Finally, in June 2008, Turkey has committed itself to signing the Kyoto Protocol.

The aforementioned initiatives show that Turkey has taken some steps to integrate sustainable development in S&T policies. To support this process, a European-funded project undertaken by the UNDP office in Ankara in coordination with DPT was undertaken.[11]

The project "Integration of sustainable development into sectoral policies" was carried out between March 2006 and March 2008. The rationale behind the integration of sustainable development into S&T policies is the need for a preventive approach to sustainable development issues. Many sustainable development policies are curative rather than preventive, in the sense that they do not anticipate problems. This can have very serious consequences if the problems lead to irreversible effects, for example if people die or if species disappear. In order to avoid such irreversible impacts and to make sure that policy measures do not have detrimental effects on our sustainable development, all policies should, from their very beginning, integrate sustainable development principles. It is to avoid that S&T policies in Turkey make such unsustainable choices that DPT and UNDP have joined forces to carry out this project. This is to make sure that S&T policies go beyond the mere contribution of science and technology *for* sustainable development, an issue which mostly deals with how innovation can enhance economic growth. Four phases are required for a policy to integrate sustainable development:

A. Consultation of the stakeholders,
B. Integrate the objectives of all the dimensions in the objectives of the policy,

[10] RIAs imply to evaluate costs and benefits, such as environmental and health ones. See http://ec.europa.eu/enterprise/regulation/better_regulation/impact_assessment/index.htm.
[11] See http://www.undp.org.tr/Gozlem2.aspx?WebSayfaNo=98.

C. Select instruments and apply them,
D. Select indicators to monitor progress and apply them.

The UNDP-DPT project has touched the first two phases and part of the fourth one. In order to integrate sustainable development in S&T policies, a two days workshop was organized. It brought together representatives from all the stakeholders of the S&T sector. In the beginning of the first day, they were given presentations to remind them of the objectives and background of the project. Most of them had attended sustainable training days organised by the UNDP and a Turkish environmental NGO Doğa Derneği. They were also explained how the workshop was going to function. The broad areas that structured the discussions corresponded to three different phases of the sector: Inputs (financial and human resources), S&T activities (basic research, …), and Outputs (patents, publications, …).
The participants were first asked to identify the problems of the S&T sector in terms of its integration of the three dimensions of sustainable development. During this brainstorming exercise, the participants were divided into three groups so that each of them could work alternatively on the three phases. For example, one group would start working on problems related to Inputs, after half an hour it would work on Outputs, and then on S&T activities. Each group appointed a person to write on a paperboard the groups' findings, which allowed the groups to benefit from the thoughts of the previous group when it started working on another phase. Once all the groups had worked on the three phases of the S&T sector, the moderator put their written contributions in an electronic format. Then, the aggregated contributions of the brainstorming of the three groups were displayed on a screen, and all the participants, not group wise anymore, were asked to separate the problems from the causes and to organise them in problem categories. Decision was always achieved by consensus, and the few problematic cases were identified as such and discussed separately later on. Finally, overarching policy targets were proposed for each of the three phases of the S&T sector:

- Inputs:
    - Ease the access to financial resources
    - Develop institutional capacities
- S&T activities:
    - Create inter-institutional coordination structures and strengthen existing ones
    - Increase competitiveness
- Outputs:
    - Increase competitiveness
    - Increase support to basic research

3.3 Results

Four problems were identified in relation to **S&T inputs**. A first problem highlighted by the participants was the insufficiency of financial resources. The main underlying cause mentioned by the participants was the macroeconomic instability, at least until 2003. Since then, inflation has been controlled and GDP has been increasing steadily. The second important cause brought up is the lack of risk capital available in the country. Third, the growing influence of the financial sector in the world economy was found to impact the Turkish economy as well. Indeed, at least before the 2002 crises, under the pressure of a massive public need for liquidity, the private sector has tended to invest its liquidities, which could have been used to invest in R&D, in the financial market. Fourth, a general lack of capital, both public and private, to carry out S&T activities was highlighted as a problem. It was also mentioned that incentive and support programmes lacked continuity. Fifth, the fact that university R&D activities were not generating enough income and outputs was brought to the fore. To the best of our knowledge, there is no study assessing the impact of these activities. Finally, it was said that resources and capital were not being used effectively. This supports the initiative formulated by the participants aiming to generalise impact assessment studies for publicly funded projects. The second problem is the weakness of institutional capacities. The main cause of ineffective implementation seems to be the lack of coordination for designing policies and strategies. An important consequence of coordination problems is that existing S&T capacities are not being used. This also explains why research outputs are seldom commercialised, and may reinforce the use of foreign R&D outputs and increase the country's dependency. Another important cause brought forward is that both public and private R&D infrastructures are not enough developed, except in the case of big corporations and established academic and research institutions. Also, there is no system for avoiding the duplication of research activities carried out by public or private agents. The third problem of a lack of skilled R&D, S&T, and vocational personnel is due to the fact that there is no strategic planning of S&T human resources. Brain drain was also said to be very problematic for Turkey. Fourth is the problem of incomplete and insufficient data and inventory. Its main cause is the lack of statistical data on technology in Turkey. For example, it was mentioned that there was a lack of information on the evolution of markets in order to direct R&D activities.

Two problems were identified in relation to **S&T activities**. The first problem points out the lack of inter-institutional coordination structures and the weakness of existing ones. The main cause behind this problem relates to the lack of complementarity among existing strategies.

The second important set of causes is associated with the way S&T activities are evaluated in the country. Concerning how S&T activities were carried out, the first cause identified behind this problem is the lack of coordination and cooperation among S&T stakeholders. Second, they underlined that these actors had difficulties in integrating the three SD dimensions into their activities. Finally, they highlighted a lack of government commitment to integrate SD dimensions into S&T policies. As regards social causes, public and private decision making processes do not integrate any social criterion when allocating resources. Concerning environmental causes, S&T activities do not contribute enough to the sustainable management of natural resources, and environmental concerns are usually ignored by industrial districts.
The second problem relates with the lack of strategic decision making and production processes of enterprises in relation to firms' competitiveness as the level of S&T activities. The first cause of this problem is the lack of firms' awareness about the importance of combining competition with collaboration, for example in the design phase of product development. Second, the group thought that organising production activities in terms of projects, which requires a lot of team work, was not a widespread practice, although no strong empirical evidence supported this claim. They are also related with problems in managing technology transfers, and with the absence of R&D departments and corresponding personnel in most firms. Finally, a last cause relates to total quality management and to environmental management.
Three problems were identified in relation to **S&T outputs**. A first category of problems relates to the weakness of R&D activities and that consequently R&D outputs are not sufficient. This is notably due to a limited capacity to commercialise R&D goods and services, reinforced by a lack of technology assessment and auditing, to a lack of information and coordination regarding S&T outputs. Environmental and ethical concerns were also raised by some of the participants; it was for example underlined that Turkey was producing too few environmental friendly products and technologies. A second problem relates to domestic and international market access, especially for SMEs, which contributes to a low level of exports of R&D-intensive products. The second cause relates to intellectual property rights (IPR), which are not used efficiently by firms, mainly because of a lack of information about them. The third problem relates to difficulties experienced by basic research outputs, such as the lack of research infrastructure in universities and research institutions; the inefficient use of human resources; the lack of support for scientific publications; and the low participation of researchers to international research networks.

Before presenting the policy recommendations, we wish to bring to the fore an interesting aspect of the idiosyncrasy of the S&T sector. This is also reflected in the literature dealing with S&T and sustainable development, which mostly focuses on S&T *for* sustainable development, namely on the positive contributions of the sector to the three dimensions of sustainable development. For example, many studies explore how can new technologies contribute to reduce environmental and health impacts or poverty. This means that the potential negative impacts of the sector on sustainable development are neither addressed nor anticipated. In the group's discussions, these negative impacts were also largely ignored, and the focus was placed on the integration of economic goals in the S&T sector. Indeed, most discussions dealt with how to make sure that the sector contributed to enhance the competitiveness of the Turkish economy. However, following discussions and additional information provided by the organisers of the focus groups, the participants were able to come up with some proposals addressing social and environmental concerns.

4. Policy recommendations

For each identified problems and causes, the participants suggested policy recommendations to improve the integration of sustainable development in S&T policies. These recommendations will be discussed in the concluding section.

4.1 S&T inputs

Four policy recommendations were made in relation to S&T inputs. First, in order to ease the access to financial resources, it was recommended to:

- Protect the S&T sector from economic instabilities,
- Design regulations for risk capital,
- Increase the amount of public funds allocated to R&D,
- Develop funds for university-industry cooperation,
- Carry out impact assessments of nationally funded R&D projects,
- Create a new unit to implement the coordination of support programmes,
- Audit publicly financed S&T activities.

All these recommendations focus on the economic dimension of SD.

Second, to better use the resources available for the S&T sector, the following recommendations were made:

- Identify the coordination unit and design the necessary legislation,

- Secure cooperation and coordination between universities, public agencies and industries by the BTYK on resource utilization,
- Define and develop sector-based S&T strategies,
- Support the national R&D infrastructure.

All these recommendations focus on the economic dimension of SD.

Third, to make up for the lack of skilled human resources the participants offered to:

- Facilitate public and private collaboration in the planning of S&T human resources,
- Develop an action plan and a strategy to reverse brain drain,
- Enable coordination in relevant areas to provide skilled intermediate staff in the S&T sector,
- Define qualitative and quantitative needs of the S&T personnel,
- Organise awareness-raising activities on SD for human resources in the S&T sector.

All these recommendations focus on the economic dimension of SD. Some emphasis was given to SD in terms of awareness-raising activities.

Fourth, to solve the problems of data incompleteness, they offered to:

- Update, activate and widely spread the use of TARABİS (Turkish Research Infrastructure Information System),
- Harmonise governmental databases and to improve its capacity and quality,
- Identify missing data, indicators, and methodological studies,
- Introduce existing data to relevant actors,
- Develop a system to analyse and monitor risks for sustainable development,
- Make governmental databases available for and usable by the actors of the S&T sector (market, R&D priorities, inventory, …),
- Develop a database comprising statistical data on the S&T sector, on existing technology inventory statistics, and on sustainable development indicators.

With these policy recommendations aiming to solve data availability problems in Turkey, the participants have made a remarkable effort to integrate the three dimensions of sustainable development.

4.2 S&T activities

Two policy recommendations were made in relation to S&T activities. First, the participants responded to the need to improve the implementation of national S&T strategies and policies by offering the creation of inter-institutional coordination structures and the strengthening of existing ones. They suggested the following measures:

- Improve the coordination of policies and actions by organisational and legislative means,

- Activate and impose BTYK's decisions in agreement with the national S&T sector,
- Articulate S&T activities in natural resource management and environmental management policies with sustainable development principles,
- Harmonise public procurement legislation with S&T and sustainable development criteria,
- Harmonise governmental support legislations with S&T and sustainable development criteria,
- Integrate sustainable development criteria into annual programmes and development plans,
- Determine which criteria should be used to develop technologies and products in conformity with national needs and priorities,
- Integrate the SD strategy in public administration reform actions.

This is one of the parts of the workshop where emphasis on sustainable development was highly cited. Together with the economic dimension, the environmental dimension of sustainable development was also highlighted, but not the social dimension.

Second, the participants offered to solve the problems of competitiveness of S&T activities by:

- Spreading the incubation system to support entrepreneurship in Turkey,
- Spreading the use of ICTs to improve Decision Support Systems in S&T activities,
- Supporting entrepreneurs in their adoption of environmental technologies and in their development of environment-friendly products and technologies,
- Designing and carrying out methodological trainings on R&D management,
- Organising site visits of enterprises by civil servants to raise awareness on S&T policies and sustainable development,
- Supporting entrepreneurship activities on know-how, design, etc.

All these recommendations mainly focus on the economic dimension of sustainable development.

4.3 S&T outputs

Three policy recommendations were made in relation to the two aforementioned S&T outputs.

First, the participants offered to solve the problems specific to S&T outputs by improving R&D processes by:

- Evaluating and strengthening the R&D support system,
- Adapting technology transfer offices to the Turkish context and empowering them,
- Improving the National R&D Information Management Network,

- Preparing sector-based strategies in production and consumption chains based on S&T,
- Improving the legislation on ethical rules,
- Ensuring the conformity of R&D products and services with SD criteria,
- Training skilled staff on R&D process management.

When formulating these policy recommendations, the participants have sought to integrate the three dimensions of sustainable development by bringing in ethical issues and other sustainable development criteria.

Second, the participants offered to solve the problems associated with the competitiveness of S&T outputs by:

- Improving the legislation dealing with the strengthening of the quality and quantity of R&D human resources in the private sector,
- Designing and organising trainings on intellectual property system, accreditation, standardisation, and by disseminating their results,
- Converting the existing investment agency into an agency dealing with investment and commerce,
- Encouraging the production and export of high value-added products and technologies,
- Improving the capital-based infrastructures of universities and research centres to meet domestic needs,
- Increasing the number and the efficiency of technology development zones and developing thematic ones,
- Developing Eco-Industrial regions,
- Rewarding successful initiatives integrating sustainable development in the S&T sector,
- Organising a regular Sustainable Development Week,
- Making environmental management systems (EMAS) mandatory in the S&T sector.

The policy recommendations made by the participants do not address the social dimension of sustainable development.

Third, the participants offered to increase the support to basic research by:

- Designing and implementing an impact assessment system targeting national and institutional programmes,
- Improving the legislation responsible for strengthening the quality and quantity of R&D human resources in universities,
- Developing international collaborations of higher education institutions,
- Increasing university resources to enhance basic scientific research,

- Enabling coordination for the applicability of basic scientific research,
- Supporting basic research for sustainable development.

Once again the social dimension is missing in the policy recommendations made by the participants.

5. Conclusion

This paper has sought to examine how sustainable development could be integrated in the S&T policies of a developing country. To do so, we have presented the Turkish S&T sector and the evolution of Turkish S&T policies, and highlighted its strengths and weaknesses. The latter have been detrimental to the economic development of Turkey, and have also deterred the integration of social and environmental issues in S&T policies. To better integrate these dimensions, the project "Integration of sustainable development into sectoral policies" was carried out by UNDP and DPT. This project was innovative with its content but also with its methodology. Indeed, it adopted a participatory approach by which all S&T stakeholders discussed sustainable development integration in focus groups, identified problems, and offered solutions.

In spite of the fact that most of the participants had received several days of training on sustainable development issues,[12] the resulting policy recommendations clearly focus on economic issues. We have argued that this was an interesting finding in itself, but that further efforts should be made to better integrate the social and environmental dimensions of sustainable development in the S&T sector.

Two problems are associated with this lack of integration. At first there is a lack of knowledge about the social and environmental dimensions themselves. Therefore, substantial training programmes should be offered to the actors of the S&T sector. We have argued that the creation of Cleaner Production Centre could take up this challenge, as it has been done in several new EU member states. These centres were sometimes publicly funded or co-funded by industry, sometimes located within universities or technoparks, or subcontracted to private consultancy firms. Second, although more and more S&T actors are concerned with sustainable development, they lack data to develop effective strategies, in both the public and private sector.[13] The lack of integration of the social and environmental dimensions of

[12] See http://www.undp.org.tr/Gozlem3.aspx?WebSayfaNo=1030.

[13] For the case of the Lithuanian Cleaner Production Centre, see *Journal of Cleaner Production*, 2004, Vol. 12, pp. 207-214.

sustainable development in the S&T sector could be made up by developing indicators allowing us to clearly evaluate this shortcoming and to propose ways to overcome it. Nevertheless, together with other shortcomings, the most important one seems to be an organisational problem. The links between existing institutions are loosely defined, the latter need restructuring, and one institution should be in charge of sustainable development integration, the best candidate being the State Planning Organisation DPT. As suggested by the participants, a restructuring effort would solve most of the problems in the sector. This reorganisation also includes restructuring of both domestic and international relations, in such a way that it integrates all the dimensions of sustainable development. It should also follow a participatory approach when integrating sustainable development in S&T policies, a strategy which has proved to be very successful in the UNDP-DPT project. In many countries with which Turkey collaborates within the European Research Area and even in developing countries, participatory decision-making approaches have become paramount to the management of the societal and environmental risks associated with S&T policies. This is for example the case of UK GMOs, of the 1999 UK National Consensus Conference on Radioactive Waste Management, of the Citizens' Foresight exercise in 2000, of the Prajateerpu initiative in India in 2002, of the UK Citizens' Jury on Nanotechnology in 2005, of the Public Engagement and Science and Technology Policy Options project (PESTO), or of the IIASA "RAINS" project. A report by Stirling and Mayer (1999) has shown how people with very different perspectives could participate in a constructive discussion and help design regulatory risk appraisal. Such examples could inspire future development in the integration of sustainable development in Turkish S&T policies.

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