TESTING ADDITINONALITY EFFECT OF TÜBİTAK'S INDUSTRIAL R&D PROJECTS FUNDING PROGRAMME: PILOT STUDY ON SOFTWARE DEVELOPMENT SECTOR IN ANKARA

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY
HÜSEYİN GÖREN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
SCIENCE AND TECHNOLOGY POLICY STUDIES

JULY 2008

Approval of the Graduate School of Social Sciences

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ABSTRACT

EVALUATION OF TÜBİTAK'S
INDUSTRIAL R&D PROJECTS FUNDING PROGRAMME
IN TERMS OF ITS ADDITINONALITY EFFECT:
PILOT STUDY ON SOFTWARE DEVELOPMENT SECTOR IN ANKARA

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July 2008, 139 pages

This thesis aims to measure additionality effect of TÜBİTAK's Industrial R&D Projects Funding Programme and try to reveal input, output and behavioral additionality effect of it. A pilot evaluation study is conducted on firms from Ankara operating on software development sector where firms who have received TÜBİTAK funding are subject to the analysis. In order to comprehend results of the analysis, first theoretical background on emergence of industrial R&D funding is explained and the need for evaluation of industrial R&D funding instruments is discussed. Then, focus is turned to major changes in industrial R&D policies in Turkey by taking into account of resolutions of Supreme Council of Science and Technology. After summarizing available industrial R&D funding instruments in Turkey, attention is turned to TÜBİTAK's Industrial R&D Projects Funding Programme and evaluation of the programme is explained in detail. The impact of TÜBİTAK funding on firms R&D expenditures, commercial successes and behavioral changes are discussed and finally the thesis ends with a discussion on the organization of this evaluation practice as well as suggestions for further evaluation studies.

Keywords: Impact Assessment, Evaluation of R&D Programmes, Input, Output, Behavioral Additionality

ÖZ

TÜBİTAK AR-GE PROJELERİ DESTEKLEME PROGRAMI'NIN FIRMA DAVRANIŞLARI ÜZERİNDEKİ ARTIMSAL ETKİSİNİN DEĞERLENDİRİLMESİ:ANKARA'DA YAZILIM SEKTÖRÜNDEKİ FİRMALAR ÜZERİNDE PİLOT ÇALIŞMA

GÖREN, Hüseyin
Yüksek Lisans, Bilim ve Teknoloji Politikası Çalışmaları Bölümü
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Temmuz 2008, 139 sayfa

Bu tez çalışması, TÜBİTAK'ın Sanayi Ar-Ge Projeleri Destekleme Programının etkilerini incelemeyi ve programın girdi, çıktı ve davranışsal artımlılık etkilerinin ortaya çıkarmayı hedeflemektedir. Ankara'da yazılım geliştirme alanında faaliyet gösteren firmalar üzerinde bir pilot çalışma gerçekleştirilerek TÜBİTAK'tan destek alan firmalar analize tabi tutulmuştur. Bahsedilen analizin sonuçlarının daha iyi anlaşılabilmesi için, ilk olarak sanayi Ar-Ge desteklerinin ortaya çıkışına dair teorik bilgiler sunulmakta ve söz konusu desteklerin değerlendirilmesine duyulan ihtiyaç tartışılmaktadır. Sonrasında, Bilim ve Teknoloji Yüksek Kurulu kararları dikate alınarak Türkiye'deki sanayi politikaları üzerindeki temel değişikliklere odaklanılmaktadır. Ülkemizdeki sanayi Ar-Ge desteklerinin kısaca özetlenmesinin ardından, TÜBİTAK'ın Sanayi Ar-Ge Projeleri Destekleme Programı hakkında detaylı bilgi sunulmaktadır. TÜBİTAK desteğinin firmaların Ar-Ge harcamaları, ticari başarıları ve davranışsal değişiklikleri üzerindeki etkilerinin tartışılmasının ardından bu tez çalışması sözkonusu değerlendirme çalışmasının organizasyonu ile ilgili konuların ve bundan sonra gerçekleştirilecek değerlendirme çalışmaları için sunulan önerilerin tartışılmasıyla son bulmaktadır.

Anahtar Kelimeler: Etki analizi, Ar-Ge Programlarının Değerlendirilmesi, Girdi, Çıktı ve Davranışsal Artımlılık

Annem için…

ACKNOWLEDGMENTS

I would like to express my deepest gratitude to my supervisor Asst. Prof. Dr. Erkan Erdil for their guidance throughout the research. Correspondingly, I would also like to thank you other members of Thesis Jury, Asst. Prof. Dr. Teoman Pamukçu, Prof. Dr. Haluk Geray, Asst. Prof. Dr. Funda Başaran Özdemir and Assoc. Prof. Dr. Nadir Öcal.

I also would like to thank to my employer TÜBİTAK and its management for allowing me to work on TÜBİTAK data. I'm grateful for their active support throughout my research.

My Colleagues, Mr. Okan Kara, Mr. Oğuz Yapar and Mr. Abdurrahman Türk are highly acknowledged for helping me to manage my daily work and their invaluable support.

Also, I would like to mention names of my colleagues, Ms. Hülya Başesen and Ms. Nalan Eser, Mr. Ahmet Pembegül and Mr. Kemal Baş for their sincere support in data collection activities.

Finally, I want to specially thank you Mr. Sinan Tandoğan for his sincere support and inspiring comments throughout this work.

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CHAPTER 1

INTRODUCTION

In a globalized world where competitiveness of nations are becoming focal point of discussion on economic growth and welfare, fostering research and development activities are getting at the forefront in government's policy agenda. Governments mostly prefer to intervene with existing market mechanism to tackle with under-investment of private sector on R&D and therefore implement various support measures varying from direct tax incentives to improving R&D climate of the country.

Project-based R&D support programmes are the most prominent tools for supporting of private firms' R&D activities. Because of its widespread implementation throughout the world, governments have started to allocate more public money to these programmes. Therefore, impact of public resources devoted to these programmes getting main concern of policy makers in a time in order to assure accountability and of economist who would like to analyze effectiveness of them.

In parallel with this emerging need, a growing literature has evolved around evaluation of R&D support programmes. Recent literature mainly posits that impact of a programme is explained its additional contribution to private R&D expenditures of firms or additional output generated by means of government funding or behavioral and organizational changes in firms where input, output and behavioral additionality are used to describe these changes.

Even though project-based R&D supports were introduced in Turkey at the beginning of 1990s, they have been increased rapidly in recent years and in parallel with its popularity, impact of them are questioned more in society. Particularly the necessity of questioning impact of the most prominent funding programme, Industrial R&D Projects Funding Programme was addressed by Supreme Council of Science and Technology.

This thesis is constructed by taking into account of the need for evaluation of Industrial R&D Projects Funding Programme and a pilot scale evaluation study is conducted to reveal impact of TÜBİTAK funding. More explicitly, research done in this thesis is organized around four research questions: First question is directed to find input additionality effect of the programme by asking R&D expenditures of the firms whereas the second question aims to reveal output additionality effect of the programme which takes commercial potential of the project as the focal point of analysis. Then, third question asks the consequences of TÜBİTAK funding in terms of behavioral changes in firms such as change in the absorptive capacity of the firm and changes in the organizational structure which points out behavioral additionality of the programme. Final question is directed to find out positive and negative aspects of the programme.

In order to find answers to these questions, a pilot scale evaluation study performed on firms from Ankara working on software development sector and their projects submitted to TÜBİTAK are subject to the analysis. This thesis first presents brief literature survey followed by detailed discussion of available evaluation methodologies in Chapter 2. Then, additionality concept is elaborated with presenting input, output and behavioral additionality separately.

Chapter 3 focuses on national science and technology policies in Turkey; however the analysis is restricted to policies related to industrial research and development. The focal point in analysis is decisions of Supreme Council of Science and Technology which is the main science and technology policy-making body in Turkey after 1980. Each council meeting is taken separately in this chapter and its decisions to be discussed in detail.

Chapter 4 reflects industrial R&D funding in operational level and presents available industrial R&D funding programmes. Since several institutions are in charge of different programmes, each programme is discussed separately but discussions also refer to the overall function of the managing institutions. Recently promulgated new R&D law brings radical advantages to R&D landscape of Turkey so that discussion of new law is also added to this chapter.

Final chapter is devoted to presentation of research results. This chapter starts with detailed description of the programme including application, assessment and monitoring procedure as well as rules regarding funding of projects. Then, evaluation study is explained by first stating research questions. Afterwards, the

reason behind selection of relevant evaluation methodology is discussed. Correspondingly, construction of sample and data collection activities explained just after methodology section. This chapter presents data analysis into five different sections, these are; input, scale, acceleration, cognitive capacity and output additionality. At the end of data analysis section, efficiency of the programme is discussed. The final chapter, then, ends with discussion of the problems observed in this study and finally points out some implications for future studies.

CHAPTER 2

THEORETICAL BACKGROUND OF INDUSTRIAL R&D FUNDING AND EVALUATION ATTEMPTS

In parallel with the growing importance of knowledge in the economy; science, technology and innovation (STI) has not only been main concern for scientists and researchers but also for economists and policy makers who want to boost performance of the economy. Since regulation of STI activities in society allows economies to produce new and improved products, processes and services in an efficient way, relationship between new product or process development and economic growth has getting increasing attention of economists in recent decades. Governments are also aware of science technology and innovation in economy and therefore, they are channeling considerable amount of national resources to stimulate R&D activities in this context.

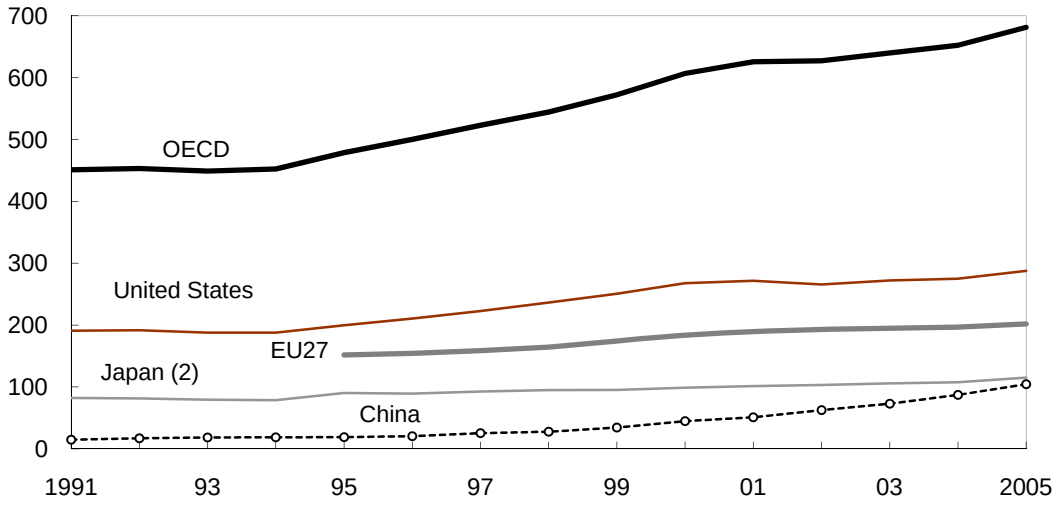
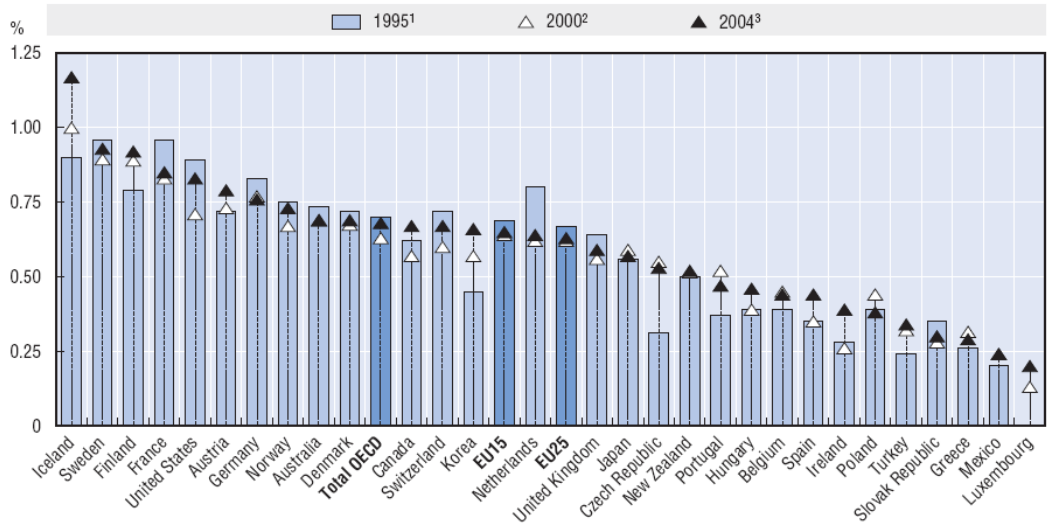


Figure 1 - Gross domestic expenditure on R&D by area, billions of USD PPP (2000) (Source: OECD, 2007)[1]

The importance attributed to R&D can be traced from Figure 1 which shows steady increase in gross domestic expenditure on R&D for all countries. Based on this figure, OECD (2006) draws attention to continuous efforts of its members on policy development and financial measures to stimulate science and innovation.

OECD (2006) also emphasizes growing importance attributed to supporting of industrial R&D activities and it is emphasized that national governments are continuously improving their national strategies on science, technology and innovation. It was also stated that some countries set targets for their R&D expenditures in order to enforce political commitment. For example, European Union has ambitious target, known as Lisbon objective, which sets gross expenditures of R&D as a percentage of Gross Domestic Product (GERD) to %3 to get high levels of growth, employment and social stability and its has binding effect on member states.

Taking into consideration of this fact, OECD (2006) underlines recent activities in member states towards consolidation and coordination of innovation programmes and states. The report points out that there is a common tendency in some countries towards supporting of business R&D by either implementing direct (grants, loans) or indirect measures (tax incentives for R&D or early stage capital funds).



[1] USD of 2000 in purchasing power parity (PPP).

Figure 2 – Government financed R&D as a percentage of GDP, 1995-2004 (Source: OECD, 2006:24)

Recent trends in OECD countries and European Union member states demonstrate significance of supporting of private R&D which obviously acknowledges the extensive amount of government financed R&D by some countries reflected in Figure 2. This figure points out that there is tremendous increase in R&D expenditures of Iceland, Luxembourg, Ireland, Spain and Korea which accounts for more than 10% increase in this period. When total expenditures of OECD countries in 2004 compared to the one in 2000, government appropriations climbed from 214 Billion USD to 265 Billion USD (in current prices).

Why governments allocate so much public money to private sector to promote R&D in the economy? What is the logic behind government intervention to existing market structure? Answers to these questions require knowledge on innovation process. Therefore, next section is mostly devoted to understand innovation dynamics and need for government intervention which will be reflected from neo-classical and evolutionary perspective.

2.1. Justification for Public Intervention to Industrial R&D

Research and development (R&D) refers to the new product and process development activities and it can also be considered as subset of the term innovation which is defined as,

> the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations (OECD, 2005:46).

Simply, R&D only covers generation of new knowledge of what to produce new and how to produce it.

The problem in knowledge-generation activities is existence of sufficiently efficient market mechanism to attain desired level of knowledge production in the economy (Norgen and Hauknes, 1999:1). Government support to R&D is justified on the grounds of existence of market failure argument which points out that firms would perform less R&D than socially optimum level where imperfections in market mechanism leads to inefficient allocation of resources to R&D (Fahrenkrog et al., 2002:15). Therefore, the following aspects in knowledge-production are listed as reasons of government intervention:

- Positive externalities or spillovers
- Network externalities
- Risk and uncertainty
- Asymmetric information
- Indivisibilities

Positive externalities or spillovers refer to the appropriation of knowledge production. Since knowledge is regarded as public-good, it can also be utilized by other companies who has not involved in the knowledge creation process. (Ebersberger, 2005:31) Especially, knowledge freely spills over to the society thanks to increasing capabilities of information and communication facilities which provide easy access to knowledge to all actors. Therefore competitors reap benefits of innovation by imitating which diminish economic benefits to R&D performer.

Characteristics of public goods also point out non-excludability and non-rivalry of consumption. Non-excludability means that it is impossible to prevent actors from consuming good. Respectively, non-rivalry refers that consumption of a good by one actor does not diminish other's benefits (Ebersberger, 2005:30). In principle, non-excludability and non-rivalry point out that information is accessible to everyone when it produced. Therefore, Fahrenkrog et al. (2002) suggested that social rates of return to R&D exceeding private ones which creates impediments to firms to invest R&D in socially optimum level.

Another problem related to market imperfections is strictly related to technical and commercial uncertainties inherent to R&D process. R&D is aimed to reveal technical barriers to reach desired final outcome and this process is risky in two aspects: Because of technical complexity, R&D process may require too much effort which causes prolongation of duration of R&D process resulted with high cost. Another risk comes from commercial uncertainty. Market potential of end product may not be exactly predicted in advance, so that it also increases risk of R&D process.

Falk (2006) asserts that information asymmetry between innovating firm and potential investor is also another aspect which creates additional risk. Because of that, investors (i.e. banks or venture capitalist) may not be sure about financial return of R&D work which prevents firms. Indivisibility aspect also

refers the same phenomena in a different way: Due to the characteristics of knowledge production explained throughout this chapter, large investment may required to undertake planned R&D work which prevents firms to complete it as planned which is defined as indivisibility aspect.

Nelson (1959) and Arrow (1962), two pioneers of innovation literature briefly acknowledge market imperfections by saying that firms will under-invest in knowledge–creation process such as R&D and innovation activities. Therefore, explanations reflected up to here are perfectly summarized as follows:

> Limited appropriability, financial market failure, external benefits to the production of knowledge, and other factors suggest that strict reliance on a market system will result in underinvestment in innovation, relative to the socially desirable level. This creates a prima facie case in favor of public intervention to promote innovative activity. (Martin and Scott, 2000:438).

However, there are strong oppositions in literature against market failure approach. Metcalfe frankly rejects market failure approach by saying that "the market failure framework, despite its formal elegance, is an empty box" (Metcalfe, 2005:60).

Metcalfe (2005) claims that positive externalities is not an impediment for innovation process because, firms can protect knowledge gained privately with patent mechanisms but patenting and intellectual property rights are losing its importance. Since product life cycles getting shorter and patenting strategy may not secure firms against positive externalities. Furthermore, Metcalfe (2005:55) claims that

> Spillovers can, and generally will, have positive benefits in stimulating the differential creation of new knowledge, which should not be underestimated; indeed, this is why patents are designed to put inventive ideas in the public domain.

Evolutionary approach also claims that non-excludability and non-rivalry characteristics of knowledge do not prevent firms to fully reap benefits of R&D. Although information can be accessible from public thanks to these characteristics, there is much more needed than cost of communication. Metcalfe (2005:59) raises attention to this issue as "to gain knowledge from information requires prior background knowledge to read that information and this knowledge has not been acquired without opportunity cost". Therefore, Metcalfe (2005) emphasized that absorptive capacity is needed to grasp benefits of information in addition to transaction cost.

Another critique of evolutionary economists is directed to uncertainties and information asymmetries. Metcalfe (2005) argues that uncertainties and information asymmetries are direct result in market process where innovation is driving force of competition. In a modern economy, innovation is one of the main sources of profit which leads to economic development. Therefore, Metcalfe (2005:58) draws attention to this fact and argues that

> One cannot sensibly argue that the economy would perform better if innovation-related activities were reduced, for the only way to reduce these uncertainties is to reduce incidence of innovation and thus to undermine the mainspring of economic progress.

System failure approach is adopted in accordance with economic climate imposed by capitalism instead of market failure approach. System failure approach does not focus on individual innovations alternatively; it envisages setting up framework conditions in order to organize related actors in innovations system to guarantee coordination among them. Consequently, it adopts more broad perspective on the instruments to be used in the promotion of innovativeness in economy and it proposes more diversified instruments directed to enhancing innovation capabilities and opportunities. To be more precise, Metcalfe (2005: 68) explains this approach by saying that "Because systems are defined by components interacting within boundaries, it follows that systems failure policy seeks to address missing components, missing connections and misplaced boundaries".

Neo-classical approach mainly concentrates on single institutions to improve existing market mechanism to foster innovation in private sector whereas evolutionary approach is built upon improving linkages between institutions in innovation system. However, supporting of R&D activities of private sector is one of the popular support instrument proposed by both approaches. Thus, Falk (2006) posits that it is expected from governments to assist firms by channeling sufficient amount of resources to innovation activity. Thereby, governments aim to solve problem of under-investment in R&D resulted from imperfections in market allocation mechanisms. Governments implement R&D support mechanisms to enhance technological progress, to increase living standards and quality of life. Consequently, the following policy instruments are implemented in line with aforementioned objectives (Fahrenkrog et al, 2002: 16):

- Financing of R&D: This type of intervention aims to compensate firms undertaking R&D activities and facing appropriation and spillover problems. Project based direct subsidies or tax incentives are main mechanisms fall in this category.

- Provision of R&D Infrastructure: The most common measure is direct government support for the formation of R&D infrastructure where market incentives are weak to provide and spillover benefits are large relative to other sectors.

- Technology Transfer and Innovation Diffusion: This mechanism is intended to stimulate diffusion of knowledge. Any types of programmes targeting creation of linkages between academy and industry, supporting of mobility of researchers and programmes or incentives enabling establishment of spin-offs constitutes this group.

- Legal Framework: Type of intervention in this group generally includes implementation of intellectual property rights (IPR) system and setting of standards which directly affect technological developments. Protection of intellectual property rights guarantees that innovating firms can get the first benefit of the commercial success of innovation and standardization ensures path of technological development will follow a desired path.

To sum up, science and technology is the key element of knowledge-driven economy of today in order to guarantee economic competitiveness and to ensure improved quality of life in society. Therefore, government intervention for promotion of R&D activities has crucial importance in this respect. Keeping this fact at the forefront, countries invested public money to promote private R&D expenses via various support measures. Spending of extensive amount of public money to increase private spending of R&D arise the need for justification. Hence, evaluation of governments' support measure is gaining importance. Next section takes this need and will discuss rationale behind evaluation of publicly funded private R&D activities.

2.2. Need for Evaluation

As explained in previous section, there are various reasons which create basis for government intervention to stimulate private R&D in order to tackle with

market imperfections as well as under-investment in R&D. Therefore, as Rye (2002) points out, the need for evaluation arises to see how successful these interventions have been in reducing market failures.

Similarly, OECD (2006:178) addresses the need for evaluation and claims that

> Evaluation helps policy makers better ascertain the intended and unintended effects of policies and programmes, to learn from past successes and failures, and to inform decisions to continue or to discontinue existing support measures or to introduce new ones.

OECD (2006:178) also points out four trends shaping current evaluation practices:

- Tighter public governance: Accountability of research funding is getting more important so that, management of public funds is becoming more conditional upon specific performance targets.
- Research as a competition: Research and development are always subject to competition but international ratings and ranking of research have gained importance which makes evaluation studies valuable
- Increasing focus on interfaces between research fields and between research and economy and society: For successful innovations multidisciplinary research is needed more and accordingly industry-academia relationships is getting at forefront.
- Technical maturity and political acceptance: Since evaluation methodologies reached maturity they provide more accurate results which help policymakers in their formulation.

In parallel with OECD arguments, a recent report prepared for European Union Directorate General Enterprise and Industry, lists several arguments for conducting an evaluation study (PREST, 2006:41):

- assessing value for money
- improving design of future programmes
- improving priority setting process
- enhancing policy design

Having these facts, there is strong need for continuous and systematic evaluation studies. This need is repeated by Fahrenkrog et al. (2002:XIV) as

"Systematic and objective process that assesses the relevance, efficiency and effectiveness of policies, programmes and projects in attaining their originally stated objectives". Definition clearly addresses evaluation in policy, programme and project level where OECD (2006:179) presents more detailed categorization of evaluation and asserts that it can be done in four levels:

- Evaluation of institutes and groups: taking basic unit of production in research and development: projects, research groups, departments, teams or laboratories
- Evaluation of institutions of operators: refers to large research performing institutions or research councils
- Evaluation of programmes and procedures: addressing public interventions targeting specific sector or technology or a generic measures or programmes having a general scope
- Evaluation of systems: consisting of whole subsets of research and innovation systems

Apart from aforementioned classification of evaluation, there are additional classification of evaluation according to anticipation from the evaluation, expected outcome and timing. When a project, institution, programme or policy is taken into consideration, at least one of the following types can be performed in order to obtain desired outcomes. Since, each type of evaluation is performed at different stage in programme, policy or research system, characteristics of each type is different from each other.

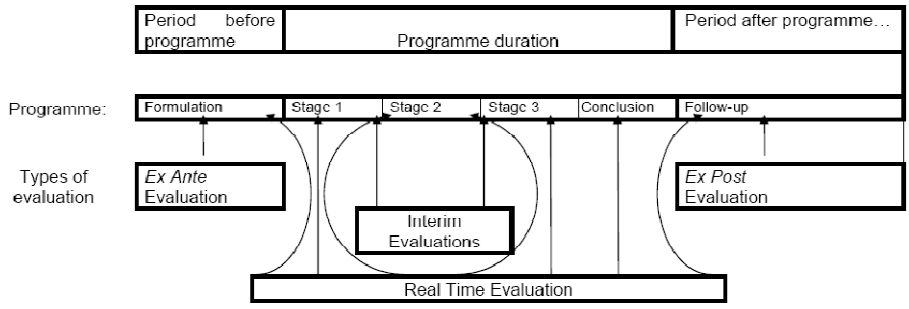


Figure 3 – Evaluation Steps (Source: PREST, 2006:62)

Ex-ante evaluation is conducted before the implementation of the programme and it measures whether existing structure of the programme is sufficient to

attain desired policy objectives. Since ex-ante evaluation involves a process of matching activities with objectives, it examines whether the objectives are realistic and if they represent adequate contributions to the broad policy goals that underpin the programme. (PREST, 2006:63). Therefore, ex-ante evaluation takes the feedback generated in this process and incorporated them into programme design.

Interim evaluation mostly preferred for evaluation of ongoing programmes or programmes spanning long duration and they are conducted in specified points in programme life cycle. The aim is to check whether the programme has been running as planned and providing expected outcomes. If not, evaluation results provide inputs for modification of the programme in latter stages.

Real-time evaluation refers to a different type of action which describes the process inherent to programme and referring continuous monitoring of the programme. PREST's report (2006:65) explains this process as follows: "evaluators are typically interacting with programme participants as the activities are being undertaken, they are attending programme events, and are able to observe what is happening". Therefore, it is beneficial in terms of providing early signals and warnings to the programme managers.

As its name implies, ex-post evaluation is performed after the completion or by the end of the programme. It takes the outcomes of the programme and analyses it with regard to number of perspectives (i.e. political, economical or social). As Fahrenkrog et al. (2002) suggests the main aim of ex-post evaluation is to provide legitimization of public money channeled to industry.

2.3. Evaluation Methodologies

Evaluation methodologies mainly draw a general framework for evaluators to achieve selected results and tell them what type of data is needed, which parameters will be used and which way the data should be analyzed and interpreted to get desired analysis. Since evaluation studies may differ in terms of its targets and expected outcomes such as, ex-ante, interim or ex-post evaluation and since its perspective adopted at the beginning may focus on political, economic or social aspects, it is logical to have a set of methods answering different needs.

RTD Evaluation Toolbox (Fahrenkrog et al, 2002) gathered all methods together and present them in accordance with the classification used for

grouping of R&D support instruments. Figure 4 shows them in a matrix format and compares each methodology with relevant support instrument. If a methodology fits relevant instrument it is marked with three dots. For example, if one needs to see the best methods to be used in evaluation of R&D financing instruments it is shown in the table that innovations surveys, econometric models, control group approaches and field/ case studies are best ones. Respectively, relevancy of each method with other R&D support mechanisms is reflected the Figure 4.

	Innovation Surveys	Econometric Models	Control Group Approaches	Cost Benefit Analysis	Expert Panels/ Peer Review	Field / Case Studies	Network Analysis	Foresight/ Technology Assessment	Benchmarking
Financing R&D	●●●	●●●	●●●	●		●●●		●	●
Provision of R&D infrastructure		●●		●●●	●●●	●●●	●●●	●●	●●●
Technology transfer and innovation diffusion	●●●	●●●	●●●	●●	●	●●	●●●	●●●	●●●
Legal frameworks (IPRs, standards and regulation)	●	●	●	●●●		●●●		●●	●●●
Integrated projects			●	●●●	●●●	●●●	●●●	●●	●●
Networks of excellence					●●●	●●	●●●	●●	●●

Legend: ●●● *Highly suitable* ●● *Suitable* ● *Less suitable*

Figure 4 – Evaluation Methodologies (Source: Fahrenkrog et al, 2002:XVII)

Since, TÜBİTAK's Industrial R&D Projects Funding Programme is used for financing of R&D activities of firms, only innovation surveys; control group approaches, econometric models and field/case studies are listed as convenient evaluation methodology according to Figure 4 and therefore they will be analyzed in detail in the following pages.

2.3.1. Innovation Surveys

Innovation data which comprises inputs, outputs of innovation process as well as process benefits of innovation activities collected at firm, industry, and programme or economy level allow shedding light on innovation and becoming a primary data collection tool for evaluation studies.

Implementation of innovation surveys started in 1970s and the early data collection efforts mainly centered on the approaches: First approach focuses on significant innovations and later on additional firm level data are associated with them. Since the center of analysis is individual innovations, this approach are named as object approach. The second

approach, called as subject approach only focuses on firms which and without having any innovation (Fahrenkrog et al, 2002: 72). Based on this knowledge, OECD standardized data-collection efforts by mainly taking into consideration of subject approach and publish Oslo Manual which defines a framework for measurement of innovation activities on a firm level.

Oslo Manual also influenced nation-wide and EU-wide evaluation surveys were performed. Fahrenkrog et al, (2002) acknowledges that Community Innovation Surveys (CIS) which were implemented in EU member states is a perfect example of nation-wide surveys. Data collected in these surveys are directed to measure technological innovation which is restricted to new product and new process development. Innovation surveys performed in national or EU level are applied on all firms whose main activity is production of goods and services for sale to the general public at an economically significant price. Firms are regarded as innovative if they introduced new or improved products or processes over three year period. In this case, if products are processes introduced to the market is new to the firm, it enough for their innovativeness Main statistical unit in these surveys is primarily firm. Depending on the scope or purpose of the data collection effort, firms can be stratified in terms of its size and sometimes large firms are covered.

RTD Toolbox identifies key aspects of innovation survey and classifies them in to five main groups (Fahrenkrog et al, 2002: 73):

- Factors influencing technological innovation: This is targeted to find out corporate strategies related to innovation process. Firms are asked to identify their objectives in innovation process, sources of innovation or obstacles. Firms mainly reflect their views based on a binary or Likert scale which grades importance as high, medium, low and not relevant.
- Innovation activities and expenditures: This section covers financial and commercial aspects of innovation activities. Mainly financial figures reflecting firms' expenditures on R&D, acquisition of knowledge (via licenses, technological cooperation with universities of other companies, consultancy services, etc), purchasing of machinery and equipment, production related activities as well as marketing.

- Characteristics of innovating firms: Size of the firm in terms of turnover or employees, its main economic activities, cooperation with other parties (either academic institutions or other companies), its organizational structure and ownership status are main items to be considered in this category.
- Impacts of innovation: The most important section of the questionnaire is composed of the questions directed to measure impacts of innovation activities on firms. Mainly sales generated from new products or processes are accepted as measurement of innovation however, some innovation surveys also collects data on the impact of innovation on development of new skills, employment or collaboration effects.

Although innovation surveys are very functional tool which collect very rich data on innovation process, it has also some disadvantages. Especially one of the most notable innovation surveys, CIS is subject to some critiques. First limitation of CIS comes from the definition of innovation which only takes into consideration new and improved products or services which fail to grasp innovation in service sector. Similarly CIS cannot measure organizational innovation because of the same limitation. The second problem is related to accuracy of the information provided by innovation outputs. It is really hard to attribute the economic performance of the firm within a definite period of time to new products and services. Smith (2005:169) underlines this problem by saying that "it is generally unclear just how much a firm's creative activity is captured by the types of innovation outputs that CIS measures".

Large scale innovation surveys conducted in national or international level are explained up to here however, surveys can also be conducted in smaller scale targeted to a specific region, rector or well-defined sample. Surveys are useful for deriving descriptive statistics about population in question. Survey data can be collected by interviews with firm representatives by means of face-to face interviews or phone interviews. Alternatively data can be collected by structured questionnaires sent to the firms by mails, or electronically via internet.

There are advantages and disadvantages associated with each way. For example, phone interview is the best when time is limited and length of

survey is short. However, face-to-face interview works well for collecting complex information and especially open ended questions provide flexibility of getting detailed information. Disadvantages of face-to-face interviews are that they require more time and money. Surveys are practical to get desired information in a fast and efficient way and frequently used by data collection purposes. For example, various researchers used innovation surveys in evaluation studies. (Fahrenkrog et al, 2002: 71) Studies done by Pianta and Sirilli (2001) entitled as "The Use of Innovation Surveys For Policy Evaluation in Italy" and Almus and Czarnitzki (2001) named as "The Effects of Public R&D Subsidies on Firms' Innovation Activities in a Transition Economy: The Case of Eastern Germany" are the best practices presented in RTD Toolbox (Fahrenkrog et al, 2002: 71).

2.3.2. Econometric Models

Econometric models are useful to assess the impact of innovation policy on economic performance. Econometric models are constructed to either reveal the impact of a policy instruments on relevant economic variables or to quantify the impact of relevant policy instruments on firm level. More explicitly, as pointed out by Fahrenkrog et al. (2002), macroeconomic models are used for evaluation of the impact of science and technology policies on employment figures, competitiveness and growth of economy.

Fahrenkrog et al. (2002) acknowledges that macroeconomic studies show positive contribution of R&D to productivity and economic growth in line with the microeconomic studies showing positive contribution of R&D on economic performance of firm. For example, Guellec and van Pottelsberghe (2000) worked on panel data of 16 OECD member countries. The aim of the study is to estimate contribution of various sources of knowledge (R&D capital stocks performed by business sector) to the productivity growth. Researchers used a Cobb-Douglas production function in which multi-factor productivity growth (MFP) of industrial sector is used as dependent variable. The stock of business performed R&D, stock of foreign business performed R&D, stock of publicly performed R&D are used as independent variable. Result of the study shows that publicly performed R&D is very important for economy. Correspondingly government-funded R&D has positive effect on business R&D.

As mentioned above, microeconomic studies show the impact on firm level data. There are two major approaches in microeconomic analysis. First approach is based on the comparison of firm's financial performance before and after the implementation of the policy measure. The aim in this approach is to see impacts of policy measure.

Another way is to use contemporaneous data belongs to firms who were not affected by specific policy measure. If a programme is subject to evaluation, funded and non-funded firms are compared with using this approach. The real challenge in this approach is to determine non-funded firms accurately. Therefore, the rationale is explained as "the underlying idea of matching methods is to imitate an experiment, in which a set of pairs of two individuals are chosen, only one is treated and the members of each pair are compared with the each other thereafter" (Fahrenkrog et al, 2002: 102)

Microeconomic models have been used in several evaluation studies so far, such as evaluation of R&D subsidies in Eastern Germany done by Almus and Czarnitzki (2001), Spain case was studied by Busom (2000). In Spain, public funding is distributed by "Centro para el Desarrollo Tecnologico e Industrial" (CDTI) which is the main agency of Ministry of Industry. R&D funding programme of CDTI evaluated in 1988 with a study performed on a sample of 154 firms, 75 of them received public funding. Two-equation framework was adopted in the study; one explains the probability of being funded and the other is firm's absolute and relative R&D efforts as a function. Second equation accepts firm size (employment), firm age, share of exports in sales, type of ownership, pricing behavior (regulated prices, monopoly, etc.), type of R&D strategy, number of patents obtained in last 10 years as parameters. The results of the study show that smaller firms are more likely to receive CDTI funding compared to large ones. In general, the programme has a positive effect on increase private R&D activities done by firms. (Fahrenkrog et al, 2002:108)

In econometric literature, a "twin" firm can be found among set of firms. As suggested by Rosenbaum and Rubin (1983) propensity score method estimates the probability of firm i to participate public measure as a function of X_i where X stands for identical set of firms. A Therefore a set of

non-participating firms, in other words, “twins” can easily be identified when X_i calculated for each firm.

The main problem associated with matching of the firms is availability of panel data. Fahrenkrog et al. (2002:104) states that

> Panel data regressions – fixed effects or random effects estimators - are appropriate when the selection process – i.e. the process that determines why firms participate in a public policy measure or not - cannot be modeled on the basis of observable variables.

The advantage of econometric models is that they enhance analytical capability of evaluators. Complex relationships between input and outputs can be understood by econometric models. Although this method helps us to understand cause-and effect relationship between numerical measures, it fails to grasp qualitative and social impacts of the policy measure.

2.3.3. Case / Field Studies

Field studies and case studies have an advantage of in-depth, direct observation of events. Generally, they entail both qualitative and quantitative data collection, including surveys, content analysis, statistical analysis of data and observation and interpretative synthesis of these data sources. (Fahrenkrog et al, 2002: 173)

Field and case studies are different from econometric studies because they are also open to qualitative questions which may require interviews as well as content analysis of documents, scenario analysis, etc. Hence, they require some amount of social interaction with the subject in analysis.

Case study done on selected firms usually starts with the collection of qualitative information from direct observation, interviews with key people from company. Analysis of firm’s economic measures and other financial and non-financial data constitutes quantitative part of the analysis. If an econometric analysis is conducted at the firm level, it may be retrospective which based on past data or it may be prospective, build upon estimation of expected outcomes of the activities in question.

Case studies are beneficial to present clear and definite evidence on the hypothesis in question. They are also valuable in presentation of best practices and success stories. Although this method is helpful in several

respects, its results are less pervasive and general inferences cannot be derived from case studies. Therefore, it cannot be used alone as a main methodology in evaluation practice however, it can be used as a complimentary to other methods.

Arguments presented under the need for evaluation section and the selected methodologies, both points out additional results and achievements which are triggered by programme to be evaluated. However, "additional achievements" need to be elaborated further and its theoretical background should be presented so that next section will discuss the emerging issue additionality and its sub-branches.

2.4. Additionality Concept

Evaluation of the public R&D support programmes is still a broad domain that a particular notion is essential to define specific contribution of public R&D support on recipients. The notion of "additionality" explains the observed difference on firm behavior resulted from implementation of specific policy or R&D support programme but "additionality" is still too comprehensive to capture the added value generated by the specific public R&D support. Georghiou et al. (2006:10) addresses the scope of the additionality as "to the extent that evaluations have addressed the specific contribution of public support, they have focused on either the amount of additional business R&D stimulated by government incentives – or the additional outputs that result from them".

In his definition Georghiou et al. (2006:12) points out that input additionality is simply measured by the additional business R&D and output additionality is similarly the measure of the additional output generated thanks to the public R&D supports. However, he criticizes that input and output additionality do not capture overall additionality generated and introduces another additionality concept as "behavioral additionality aims to measure explicitly changes in the ways firms conduct R&D as a result of government instrument" (Georghiou et al., 2006:10).

In order to measure overall additional affect of public R&D supports, additionality concept should be analyzed in to three separate categories:

2.4.1. Input Additionality

Input additionality measures the proportion of inputs which would not have been allocated without public support. (Clarysse et al., 2004:7) Simply; if every Euro channeled to the firms by government stimulates them to spend an additional Euro on R&D, input additionality occurs as a result of intervention. However, government intervention may not create input additionality, sometimes it may crowd out firms' resources.

Although input additionality makes a connection between government intervention and firms' R&D investment, it fails to reflect real-world situation because it is based on the following assumptions (Bach and Matt, 2003:108):

- There is a clear link between input and output in the innovation activities
- Divisibility and constant returns to scale of the innovation activity
- No difference in the nature of the output generated by public and private funding

Input additionality has some limitations because of the aforementioned assumptions and Falk (2006:4) criticizes it from a different perspective with following argument:

> The problem associated with the input additionality is that it relays on the oversimplified linear model of innovation which assumes a direct link between primary innovation inputs and respective payoffs.

2.4.2. Output Additionality

Output additionality is defined as "the proportion of outputs that would not have been achieved without public support" (Georghiou, 2004:7). Here, the term output covers academic papers and patents resulted from R&D and the commercial applications of the generated new knowledge such as new products, processes and services.

However, output additionality has some limitations similar to input additionality. For example, R&D projects may not result in a specific product, service or process. Even if it looks that project fails to produce such output, it may increase the existing stock of knowledge either by increasing the number of researches in the firm or by increasing experience of researchers. Alternatively, it is sometimes hard to attribute an output to

a single project because it may be realized as the consequence of more than one R&D project or the knowledge acquired outside of the firm.

Apart from new products, processes and services academic papers and patents fail to be a good output indicator because, firms sometimes avoids to formalize their innovations via patenting or academic publishing. Conversely, Falk (2006:4) asserts that patens or other intellectual research output are of no value to the firm unless they are converted into new products, processes and services.

2.4.3. Behavioral Additionality

Since the limitations of the input and output additionality fails to explain the additional effects of R&D support on the firms, behavioral additionality concept is developed to explain difference in firm behavior resulting from a government intervention (Georghiou et al, 2006:13). Other additionality concepts tend to focus on the econometric measures but often they are inadequate to grasp the intangible assets generated within the firm and changes in organizational routines and ways of performing R&D projects.

Since behavioral additionality refers to a collection of changes in firms some researchers re-name it as process based additionality and define more explicit concepts. For example, as shown in Figure 5 scale, acceleration and cognitive capacity additionalities are defined as a subset of behavioral additionality.

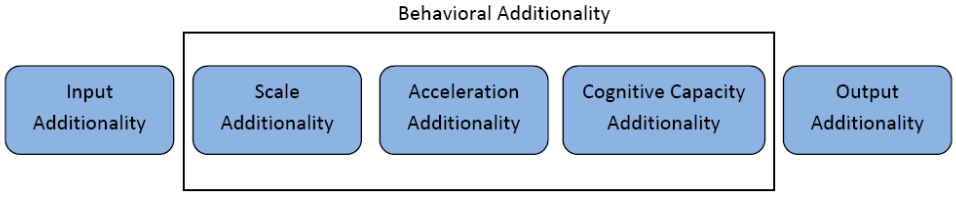


Figure 5 – Types of behavioral additionality (Source: Falk, 2006)

Scale additionality exists if the presence of government R&D supports changes the size of the project or investment. Falk (2006:4) states that "scale additionalities are said to be on hand if public funding allows the project to be conducted on larger scale".

Acceleration additionality refers to the speeding up the pace of the project as a result of government funding. Falk (2006:5) explains acceleration additionality by listing its observable outcomes as "an earlier start date of the project, a shorter implementation phase or project results are accessible at an earlier date".

Cognitive capacity additionality is strictly related to knowledge accumulation of the company and it refers to organizational learning. Since collaboration and networking between firms and other parties (universities, research institutes or other companies) involves both individual and organizational learning, they increase competencies of the firm and individual as well as their absorptive capacity, the existence of such activities signals positive cognitive capacity additionality. (Falk, 2006:5)

2.5. Sample Evaluation Studies

2.5.1. Evaluation of ANVAR

ANVAR is an independent; government-owned French innovation agency that supporting innovation projects of SMEs. The agency has been operating for more than 25 years. ANVAR has been managing the oldest and the largest innovation programme, "I'aide au projet d'innovation" in France. The programme has channeled more than one billion Euros for 7000 innovation projects in around 5600 companies between 1993 and 1997. (OECD, 2006:187)

The programme was launched in 1979 and its aim is to support SMEs by providing them loans up to 50%of its whole project cost. Support is provided to SMEs as a soft loan that SME have to pay back fails if project ends successfully otherwise, it becomes a grant.

The agency was evaluated in 2001 by an independent agency Technopolis. Technopolis used the following approaches in this study: (Warta et al, 2002:4):

- A postal questionnaire survey was sent to clients and potential clients
- Company visits organized to selected companies and in-depth case studies was done with them

- Face-to-face interviews organized with ANVAR representatives in order to analyze management and administration of ANVAR
- Benchmarking of programme with its international equivalents was done: Norway's, and Ireland's funding programmes as well as Small Business Innovation Research (SBIR) and Manufacturing Extension Programme of USA were analyzed.

The results of analysis is declared by OECD are as follows: "the report could demonstrate a positive impact of the programme on development of new products, the expansion of customer bases and the creation of jobs" (OECD, 2006:187).

In addition, final results are summarized in the following headlines:

- the impact of ANVAR funding is more important for young companies often in traditional sectors
- the capacity of the firms to integrate the commercial and marketing aspect can still be reinforced
- Advise to the management: to improve promotion of the programme in small regions, make a special treatment for young firms

At the end of the report, there was a message to French authorities to keep open evaluation procedures for all programmes supporting innovation.

2.5.2. Evaluation of EUREKA

EUREKA in inter-governmental initiative established in 1985 aims to enhance competitiveness of Europe by generating and funding of close-to-market projects targeting to develop innovative product, process and services. EUREKA is composed of representation of 38 member states[2] and it trying to harmonize national funding comes from national programmes of its member states in order to support EUREKA projects.

When EUREKA project portfolio is analyzed, it can be seen that most of its clients comes from industry and SMEs has quite large share in the portfolio. 42% of its project applications come from SMEs whereas large companies' share only constitutes 30%. (EUREKA, 2007)

[2] The list of EUREKA Member States can be reached from the following website: http://www.eureka.be/contacts/home.do

EUREKA has been subject to several evaluation practices so far and there was major evaluation studies done in 1991 and 1999. However, EUREKA started to implement Continuous and Systematic Evaluation (CSE) procedures in 1996. CSE is composed of one long technical report which is submitted to all project participants at the end of the project and two market impact reports. Market impact reports are short follow-up questionnaires to measure commercial success of projects and they are sent to all project participants after one, three and five years following the completion date of the project.

The analysis was based on 343 (technical) final reports, 265 of them come from firms and others from non-industrial partners. In addition, 37 market impact reports and 30 face-to-face interviews added to the analysis. (Georghiou, 1999:73)

Evaluation (practice) comes up with interesting results on commercialization performances of projects: Although 78% of participants were expecting commercialization at the end of the project, one third of them failed after one year which is explained "as initial expectations based upon technological success may not be realized in the market" (Georghiou, 1999:74).

Regarding contribution of the projects to the turnover, evaluation produced remarkable findings: Nearly half of the projects achieved little or no effect on turnover while 2% of the projects generated 45% of turnover (Georghiou, 1999:74). Evaluation practice did not reveal any concrete results on employment results of the project because; it was observed that firms were uneasy about responding the question related to employment.

2.5.3. Evaluation of Advanced Technology Programme (ATP)

ATP was established to support innovation activities of firms in order to close the gap between research and market and it focuses on the needs of industry in United States of America. ATP states its mission to support early stage investment need of firms in order to accelerate development of innovative technologies which has high commercial potential and widespread benefits to United States.

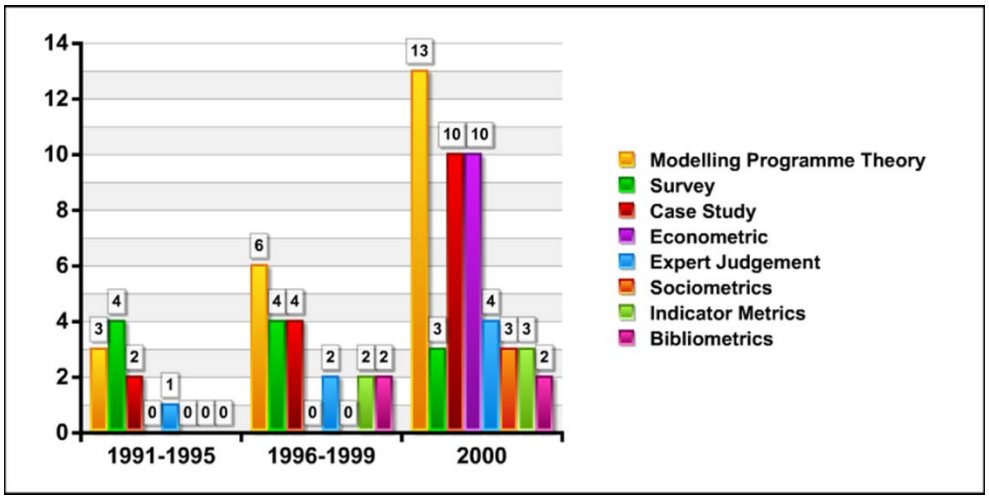


Figure 6 - Intensity of ATP's use of Evaluation methods (Source: Ruegg and Feller, 2003:69)

ATP has undergone various evaluation studies starting from 1991 and since ATP's mission is quite complex and covers broad area selection of single test or method was not adequate to capture benefits of the programme. Therefore, evaluation practices have been constructed around the following test questions (Ruegg and Feller, 2003:67):

- Has the portfolio of ATP funded projects that produce large net social benefits for United States?
- If ATP funded project produced large benefits addressed in 1st question, is the large share of benefits attributable to ATP?
- Has the portfolio of ATP funded projects contributed to enhance United States economic and technological competitiveness?
- Regarding the distribution of net benefits, do they extend well beyond the direct ATP award recipients?

In line with these questions ATP used different evaluation methods whose change can easily be traced from Figure 6, and it was emphasized in Ruegg and Feller's (2003:64) report that "One strength of ATP's evaluation program has been its strategy to use a variety of methods to evaluate program effects, choosing the best method for the task rather than focusing on a single method".

OECD also points out the variety in evaluation reports and with making reference to this variety it addresses the rough results, for example OECD says that business reporting system enables to track progress towards

future application of technologies which makes easy to perform analysis of the portfolio of projects. In this report, case studies also effectively used in this processes and to understand the effects of ATP projects in firm level and to explore rate of adoption of technology, to measure spillover benefits and costs (OECD, 2006:188).

CHAPTER 3

MAJOR DECISIONS IN TURKISH INDUSTRIAL R&D POLICY

The history of science and technology policies in Turkey does not date back to the establishment of Turkish Republic in 1923, because the main concern for that period was restructuring of national economy which had been lasted for 40 years. Hence, national research and development strategy was not in the high-ranked items in the agenda for those years. The first emergence of science and technology policies coincides with Turkey's full membership with Organization for Economic Development and Cooperation (OECD) on 14th of December 1960 as well as government's efforts to transition to planned economy. Turkey's OECD membership is important in a sense that OECD created a demand on member states for designing national science and technology policy.

It was the first time that Turkey's national research and development (R&D) strategy was addressed in first Five Year Development Plan as a separate policy item. (Erichsen, 2003) First Five Year Development Plan was concentrated on nurturing scientific activities to increase role of science in economic development but term "technology" was not appeared in the plan at this time. However, the plan includes a statement which points out establishment of Scientific and Technical Council of Turkey (TÜBİTAK)[3]. As it was addressed in first Five Year Development Plan that TÜBİTAK was established in 1963 with a mission to support basic and applied research as well as encourage young scientists to undertake more research. (SPO, 1963:467)

Even though, Turkey had major leap in 1960s by addressing importance of scientific activities in first Five Year Development Plan and establishment of TÜBİTAK, the years following establishment of TÜBİTAK, Turkey was quite inactive in terms of science and technology policy matters. The inactive period can also be

[3] Scientific and Technical Research Council of Turkey was renamed in 2006 as Scientific and Technological Council of Turkey but its abbreviation always remains as TUBİTAK

traced from second, third and fourth Five Year Development Plans and whose Science and Technology Section only includes generic statements and lack of any concrete policy recommendations.

However, 4th Five Years Development Plan has critique of TÜBİTAK which states that TÜBİTAK failed to establish linkages between science and technology policies and economic development foreseen in Five Years Development Plans. The main inadequacy in its strategy was presented as TÜBİTAK had mainly concentrated on universities instead of industry. (SPO, 1979: 48)

As stated in 4th Five Years Development Plan, TÜBİTAK mainly focused on funding of basic research performed in universities. However, Turkish industry was quite immature at that time in terms of its R&D capabilities and actual need was having an institutional structuring of applied R&D which would feed industrial activities. Therefore, TÜBİTAK started to establish research institutes to provide contact based R&D services for industry. First R&D institute was on electronic research but in a time the number of research institutes have been increased and some of them were grouped under a Marmara Research Center and created a separate research campus in Marmara region. TÜBİTAK's research institutes become main actors in national innovation system on applied research and they established successful cooperation with industry.

Socio-economic problems in 1970s prevented Turkey to take breakthrough decisions related to scientific and technological issues whereas starting from recovery period there were some signals to revitalization of policy actions in science and technology domain. The biggest milestone at that time was establishment of Supreme Council of Science and Technology (SCST) in 1983 as a highest level policy making body in Turkey.

In the following years, SCST acted as main body in science and technology policy formulation and produced many important policies and shaped national science and technology policy. Starting from its establishment, SCST acts as main body in Turkey who influences government in the formulation of national policies and coordinates all relevant actors in national science and technology system.

Next section is entirely devoted to the analysis of SCST from the perspective of Council's approach to industrial R&D policies. First, structure and responsibilities of the Council are addressed and then resolutions taken in each meeting are

briefly summarized according their relevance to industrial R&D. Finally, critique of all resolutions is presented at the end of the section.

3.1. Supreme Council of Science and Technology

Rapid changes in 1980s urged the need of having an authority on STI policies and accordingly Supreme Council of Science and Technology (SCST) was established by a decree (decree no.77 published in the Official Gazette no. 18181) on September 4, 1984. (TTGV, 1997) SCST is the main authority in charge of setting policy recommendations, coordinates institutions of national innovation system, and deciding on the future R&D priorities in Turkey. The council is directly chaired by Prime Minister and composed of many ministers and high-level officers. Its duties are stated in the decree as follows (BIS-RTD, 2007:3):

- To assist government determination of long term science and technology policies
- To identify R&D targets related to science and technology areas
- To determine priority areas in R&D and to prepare related plans and programmes
- In accordance with these plans and programs to assign public organs, to cooperate with private enterprise sector when necessary, and to identify regulations and promotion schemes related with private enterprise sector,
- To have law and legislation proposals prepared in order to develop and increase the effectiveness of S&T system
- To identify means for development and effective utilization of R&D human resources and assure their implementation
- To set procedures for establishment of R&D centers of private institutions monitoring and evaluation of their activities
- To determine in with research fields and in what proportions R&D investment to be made
- To provide coordination among sectors and institutions in programming and implementation stages

These duties ensure challenging position of SCST and make it a key player coordination of Turkish STI system. To note that, SCST is not a higher management body of TÜBİTAK; it is the highest body in Turkey responsible for

regulation of all actors and the following sections, will explain efforts made over time.

In order to comprehend function of SCST in determination of Turkey's industrial R&D policies, its resolutions over time should be scrutinized. Next section is devoted to the analysis of SCST decisions which is organized in a way that each meeting is taken separately and its resolutions are discussed in terms of their relevance to industrial R&D policy.

3.2. Analysis of Council's Resolutions

After the first meeting on October 9th, 1989 SCST has gathered 16 times until by the end of 2007 and announced many important resolutions which shaped STI policy in Turkey. Of course, its resolutions cover different sectors and affect many institutions in Turkey but in terms of industrial R&D strategy, SCST underlines the importance of promotion of industrial R&D for Turkey and there have been clear messages and concrete policy recommendations from the beginning. Almost every meeting has a decision or recommendation on planning, organization, implementation, improvement of industrial R&D in Turkey so that the frequency of the council meetings which can be tracked from Figure 7 is a very rough measure of the significance attributed to the regulation of industrial R&D policies.

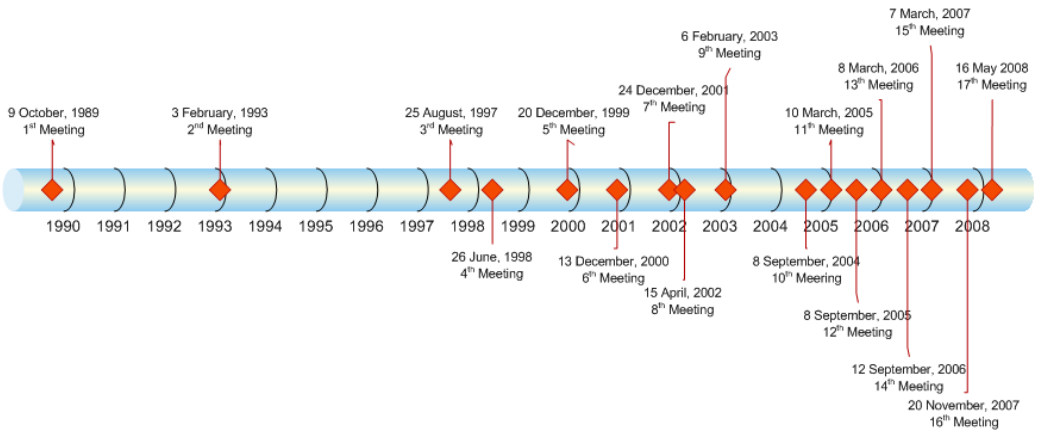


Figure 7 – Meeting dates of SCST (Source: Own drawing)

As shown in the figure, last 8 meetings have been periodically organized each year which clearly demonstrates policymaker's strong commitment on science and technology. Even though periodic meeting schedule gives clear message of the importance attributed to science and technology policies covering

industrial R&D, decisions and policy recommendations adopted in each meeting should be scrutinized in detail in order to reveal concrete results and actions. Therefore, the following section will includes brief discussion of each meeting.

3.2.1. 1st Meeting

Minutes of first SCST meeting looks like an analysis document which states the expression of government's intention to improve research and development capabilities of Turkey. The clearest action reflected in the meeting report is the emphasis on the implementation of some tax incentives to private sector undertaking R&D but details on this facility are not presented.

The report of first meeting includes some targets for the next ten years. For example, it was foreseen that number of researchers for per 10.000 people would be increased to 30, the share of gross domestic expenditures on R&D (GERD) as a percentage of gross domestic product (GDP) would be increased to 2% (SCST, 1989:1).

Whereas, there are no clear policy recommendations for industrial R&D in the document and it was ended by a wish stating that next meetings would take necessary resolutions according to the report provided by TÜBİTAK.

3.2.2. 2nd Meeting

2nd Meeting was held approximately three years later from the first one and resolutions adopted in this meeting starts with the re-definition of the targets covering the years between 1993 and 2003. New targets seem less ambitious compared to the previous ones some of which related to industrial R&D indicators are summarized below:

- To increase Number of researchers per 10.000 people to 15 (current figure at that time was announced as 7 researcher per 10.000 people)
- To increase current value of the GERD as a percentage of GDP from 0,33% to 1%.
- To increase private sector's share in R&D expenditures from 18% to 30%

In addition to these targets some key technology areas are listed as the strategic priorities of Turkey for the forthcoming years and these are: information technologies, advanced material technologies, biotechnology, nuclear technology and space technologies.

A specific target for privately funded R&D is set in this meeting and seven different actions, each of them are described in detail and summarized below, are identified to reach this target:

- Funding is needed to promote R&D conducted by private sectors: It was stated that studies on industrial R&D funding was started in 1991 and TÜBİTAK's regulation was changed accordingly in order to allow funding of industrial R&D projects and a separate legal entity. At the same time it was stated that Turkish Technology Development Foundation (TTGV) was established and a loan worth 43 Million USD provided by Word Bank was consigned to it. However, the need of close coordination between TTGV and TÜBİTAK was addressed.
- Small and Medium Sized Enterprises (SMEs) should be encouraged to undertake more R&D: It was advised to create a separate programme supporting of project based R&D activities of SMEs and Small and Medium Sized Industry Development Organization (KOSGEB) was addressed for the management of such programme.
- It was stated that multi-national enterprises having investments in Turkey should be encouraged to open R&D department in Turkey.
- The need to the establishment of venture capital market was expressed.
- The urge for coordination between TÜBİTAK and TTGV was addressed to cooperation on preparations of regulations regarding science parks.
- It was declared that production based on innovative product design should be encouraged instead of production based on license acquisition
- The intention of the update of the related law regulating patenting and intellectual property rights was announced. (SCST, 1993:16)

Even though the policy implications in these explanations look very brief and sometimes ambiguous, they addressed very important issues and

created legal basis for the future actions. For example, the importance of TTGV was addressed for funding of industrial R&D activities and closely connected to this; implementation of a separate programme within TÜBİTAK for funding of industrial R&D was signaled.

Decisions taken in this meeting also published as a separate document entitled as "The Turkish Science and Technology Policy: 1993 – 2003" and became one of the important policy documents in 1990s.

3.2.3. 3rd Meeting

Third meeting first states recent trends in the world in terms of science and technology policies and try to analyze the position of Turkey in this respect. Two trends are underlined in the document: rapid transformation of the society towards "information society" and the increasing pressure of "globalization", which mostly shaped resolutions adopted in this meeting.

SCST resolutions first underline the importance of the new policy plan, prepared in full compliance with "The Turkish Science and Technology Policy: 1993 – 2003" policy and in line with the suggestion indicated in 7th Five Year Development Programme and this plan entitled as "A leap in Science and Technology Project". The policy simply highlights seven critical policy recommendations for Turkey in the future:

- To establish national information network in which telematic services network operated in order to prepare Turkey information society
- To prepare relevant national actors to implement flexible manufacturing and automation technologies
- Renewal of national railway to comply with high-speed railway technologies and to start urban railway transportation services
- To follow national investment and development strategy in Turkish industry for space, aeronautics and defense technologies
- To focus on R&D in gene engineering and biotechnology (to explore possibilities of implementation of them in Southern Anatolia Project[GAP])
- To focus on and to widen the implementations of environmental friendly technologies and energy technologies

- To promote R&D and investment on advanced material technologies in order to support other relevant technologies

SCST states that some actions has already been done on the previously approved policy document (The Turkish Science and Technology Policy: 1993 – 2003) and lists eleven actions put in force until this date. Two of them were related to the establishment of two new institutes (Turkish Academy of Sciences and Turkish Patent Institute), one of them was about to start a new programme within TÜBİTAK to support international scientific publications, seven action were related to regulation of intellectual property rights, one of them addressed long term strategy planning study on information society but only one of them was related to industrial R&D activities.

SCST first announces that Grand National Assembly of Turkey (TBMM) signed General Agreement on Tariffs and Trade which is also known as Uruguay Round Negotiations in 1995 (act no.4067 on January 26, 1995) and by means of this agreement, serious restrictions was put in force on direct subsidies of economical activities.

Then, it was stated that new programme for supporting R&D expenses of private companies has been launched with the decree regarding to R&D (Money-Credit Coordination Committee, 1995). Accordingly, announced that TÜBİTAK and Under-secretariat of Foreign Trade (DTM) was signed a protocol regarding new programme. The aim was to support 50% of R&D expenses of companies by government and it was expected from firms to cover remaining expensed from its own budget. However, soft loan provided by TTGV was also mentioned for the remaining 50%.

In addition to previous announcements, several new policy recommendations were also announced in this meeting. As a first step SCST proposed the creation of national R&D budget to cover R&D expenses of all support programmes including industrial and academic R&D to prevent duplicate funding and for better coordination. Also, SCST expressed its intention to process the payment procedures of R&D programme without any delay thanks to the full support from government.

SCST also raised the concerns for supporting of SMEs in advantageous way and underlined to re-structuring of KOSGEB and it was decided that a

separate workgroup involving TÜBİTAK would be established in order to do that.

Another important item in SCST's agenda is the establishment of University-Industry Joint Research Centers. SCST expressed its appreciation of the creation of a new programme to support the centers. In this programme, TÜBİTAK provide certain amount of contribution to the centers and closely monitors the development of them.

SCST also announced its appreciation towards enthusiastic step towards promotion of international R&D collaborations with other European countries and thereby to assign TÜBİTAK to chair EUREKA programme between 1998 and 1999. Ministry of Foreign Affairs and Ministry of Industry and Trade was addressed to help TÜBİTAK to succeed organization of chairmanship.

In line with previous resolutions, SCST has again underlined the urge for establishing venture capital fund, coordination of activities on technology development zones, promotion of innovation activities of SMEs. It was decided that separate workgroups are created for biotechnology and gene engineering, energy efficiency and renewable energy and marine sciences. TÜBİTAK is designated a member of each groups. (SCST, 1997)

To sup up, 3rd SCST meeting came up with many important resolutions and statements shaped industrial R&D funding in Turkey. Decisions adopted this meeting covers announcement of the implementation of new instruments as well as policy recommendations on different industrial R&D support mechanisms which clearly demonstrates liberalization of Turkish economy. Therefore, SCST warns government in the adoption of new instruments to increase Turkish industry's competitiveness.

3.2.4. 4th Meeting

This meeting was held approximately one year later from the previous one and the agenda of the 4th meeting is quite similar to the previous one and there were no new resolution taken for improvement of industrial R&D policies and they are mostly reflect recent development on previous agenda.

Regarding creation of national R&D budget, there was no actual development on that matter but and it was stated that discussions are mainly going around funding of academic R&D projects.

However, a separate section devoted to industrial R&D funding programme in this meeting. It was indicated that TÜBİTAK and DTM have settled up an agreement on the following modification of the programme and noted that these changes was submitted to money-Credit Coordination Committee on 4th of March 1998:

- To increase maximum funding ratio from 50% to 60%
- To implement new measures to compensate inflation effect
- To encourage applying Turkish Patent Institute by implementing new regulations
- To increase funding ratio of R&D personnel
- To support joint R&D projects with R&D centers to encourage university-industry partnerships
- To implement new regulations for firms and universities participating international R&D projects
- To add environmental friendly technologies to priority technology areas (SCST, 1999:26)

Brief information about University-Industry Joint Research Centers has also been presented in this meeting and announced that the following centers has been established:

- Gaziantep University-Industry Joint Research Center
- Eskisehir University-Industry Joint Research Center on Ceramics

Regarding to other previous resolutions related to industrial R&D funding, it was understood that nothing important was happened in this period and studies has been still going on in venture capital funds, promotion of innovation activities of SMEs as well as re-organization of KOSGEB.

3.2.5. 5th Meeting

SCST reported several developments and changes related to Industrial R&D Grant Programme[4]. It first announced that proposed changes in the previous meeting has been approved and published in Official Gazette on

[4] Industrial R&D Grant Programme was re-named as Industrial R&D Projects Funding Programme in 2005

4th of November 1998. (Money-Credit Coordination Committee, 1998) secondly, SCST reminded the protocol between TÜBİTAK, KOSGEB and TTGV signed in 28th of December 1998 concerning the promotion of technology development activities of SMEs and it was acknowledged that KOSGEB provided additional support to SMEs receiving grant from TÜBİTAK. However, KOSGEB executive committee abandoned additional support and the council expressed its disappointment on that matter.

SCST also announced that the programme had already received more than 1000 applications from more than 500 different companies but underlined that there were a problem concerning the definition of "industrial firm" which defines characteristics of firms eligible for application. Since definition at that time excludes small sized firms trying to perform R&D on advanced technologies such as biotechnology and agricultural technologies therefore, it was suggest that any firm with any size creating added value can apply for the programme.

Minutes of the meeting indicates some developments regarding to other relevant activities. First, it was declared that World Bank allocated 155 Million US Dollars to Turkey for the second phase of second Industrial Technology Development Project and 60 Million US Dollar was dedicated to TTGV's for supporting technology development project and related agreement was signed on 2nd of July 1998.

Regarding venture capital fund, a regulation for Venture Capital Trust mechanism was published in Official Gazette but it seemed that it was too generic to implement and additional studies were still needed. However, TTGV was planning to be a shareholder of venture capital trusts with the support of World Bank funds.

3.2.6. 6th Meeting

6th Council meeting was heavily focused on technology foresight project and several recommendations were stated in the document. Therefore attention was turned from industrial R&D funding to foresight activities and only a few resolutions were mentioned in the committee. It was the first time that Turkey's participation of Framework Programmes was mentioned in this SCST and the committee appointed TÜBİTAK a coordinating body and to charge other relevant bodies, such as Ministry of Foreign Affairs, Ministry

of Finance, Under-secretariat of Treasury, State Planning Organization, and etc.

Another relevant announcement was the establishment of venture capital trust by TTGV and Türkiye İş Bankası and it was mentioned that TTGV was planning to set up second venture capital mechanism with European Investment Bank. (SCST, 2000)

3.2.7. 7th Meeting

This council meeting had clear statement for Turkey's participation of 6th Framework programme and it was underlined that signing of framework agreement and approval of it by Grand National Assembly of Turkey might took some time, the commence of preparations is strongly advised. It was repeated that TÜBİTAK was assigned as a coordinator in this process and an appropriate departmental organization was recommended within TÜBİTAK fully compliant with "National Contact Point" organization. (SCST, 2001)

There are no additional concrete recommendations regarding industrial R&D policies in the rest of the meeting report.

3.2.8. 8th Meeting

The main emphasis in this meeting was given to Turkey's participation to 6th Framework Programme which a separate section was devoted to the analysis of potential benefits and engagements in case of participation. Comprehensive analysis documents both reflect TÜBİTAK's view as well as other related institutions, ministries, universities, higher education council and document come up with a strong recommendation on Turkey's participation to the 6th Framework Programmes. Then, Council declared that after the succession of negotiations with European Union, it was decided to sign memorandum of understanding and present it to Grand National Assembly of Turkey for final approval. (SCST, 2002)

Other main topic in this meeting is foresight implementation of foresight exercise so that TÜBİTAK requested additional budget from government to continue activities according to the plan. In addition to these resolutions, there was no decision related to industrial R&D.

3.2.9. 9th Meeting

Large portion of 9th Meeting was also devoted to Turkey's involvement to 6th Framework programme but in this time it was stated that Turkey's participation was formalized and memorandum of understanding was signed on 29th October 2002.

The council states that preliminary results of foresight exercise were announced on 23th of January 2003 to commence discussion in the society. After getting comments, consolidation meetings were planned between March and June to prepare final document and then it was announced that first foresight exercise of Turkey would be published on 23th of July 2003.

Another important item in council's agenda is increase in the share of R&D in national income. It was acknowledged that current figure of GERD as a percentage of GDP is 0.67% which was the one third of European Union average at that time. EU's commitment to increase its average from 1.9%to 3% within 10 years presented as a stimulus for the adoption of new strategy for Turkey. Several recommendations, summarized below, were presented in this meeting:

- To increase the well-trained R&D personnel and to launch new scholarships for PhD studies for Turkey's priority technology areas
- To attract Turkish citizens living abroad and having PhD degree
- To improve R&D capacity of SMEs and to implement venture capital system (SCST, 2003)

3.2.10. 10th Meeting

10th SCST meeting starts with an important resolution which declares that science, technology and R&D should be targeted to increasing quality of life of the nation, solving social and economic problems, improving competitive power of the country and disseminating science and technology to the society. Keeping this statement in mind, SCST underlined the need of creation of result oriented new strategy covering years between 2005 and 2010 and suggested that new strategy would be constructed around three main objectives:

- To increase the demand to R&D
- To increase quality and number of scientific and technical workforce
- To increase share of R&D expenditures as a percentage of GDP

To realize these objectives, SCST officially announced new targets, to increase the share of R&D expenditures to2% until 1010 and to increase number of full time equivalent R&D personnel to 40.000. The council recommended that all necessary precautions should be taken to achieve these targets and advised government to allocate sufficient additional budget to TÜBİTAK starting from 2005. (SCST, 2004)

This resolution is important in a sense that it shaped short term science and technology vision of Turkey and convinced each stakeholder participating in SCST to move same direction as vision states. Therefore, Turkish Research Area (TARAL) has been defined in line with this vision to coordinate all stakeholders.

3.2.11. 11th Meeting

11th SCST has announced updated science and technology vision of Turkey and announced that "A leader Turkey (was targeted) who achieved the adoption of science and technology culture by society and managed to turn scientific and technological knowledge to products in order to increase quality of in a sustainable way".

Based on the results of Turkey's first technology foresight exercise, Vision 2023, SCST updated priority technology areas and advised all actors of TARAL to focus on these areas during their related activities. These areas are as follows:

- Information and communication technologies
- Biotechnology and gene technologies
- Material technologies
- Nanotechnology
- Design technologies
- Mecatronics
- Manufacturing processes and technologies
- Energy and environmental technologies (SCST, 2005a)

In line with the resolution of the previous meeting, government allocated remarkable budget to TÜBİTAK in order to finance R&D activities and the council announced the amount of funding as 446 Million New Turkish Lira (YTL). It was acknowledged that such amount would not be used to finance

large infrastructure investment instead it would be used to following finance project-based activities:

- Producing solutions to academic, commercial or socio-economic problems
- Having an end-user(s) or designed by taking into account of the needs of end-user(s)
- Creating added-value for enhancing quality of life of the nation
- Solving major problems of society
- Creating added value to enhance competitive power of the country
- Targeted to strengthen geographic, natural or humans resource potential of the country
- Developing solutions/preparations for potential problems of threats the country will face soon
- Targeting to improve scientific (and technical) workforce
- Fostering collaborations (between university, industry, public institutions, and non-governmental organizations) to strengthen TARAL structure
- Having a potential to disseminate science and technology to society (SCST, 2005a)

In addition to these criteria, TÜBİTAK committed to use Oslo, Frascati and Canberra Manuals as a reference documents in selection and evaluation of R&D projects and collection of R&D data and statistics. It was underlined that such decision would ensure conformity in terminology and facilitates adoption of European Union standards.

11th SCST also approved "Science and Technology Policies Action Plan" which provides a general framework for set of activities for next 5 years. Action plan 7 different sub-titles covering different aspects of STI policies and constitute a legal basis for new initiatives targeting the improvement of R&D capability of Turkey.

3.2.12. 12th Meeting

12th SCST meeting referred resolution of 11th meeting stating the funding dedicated to TÜBİTAK and presented the amount of money used by each department. The official figure of the total amount of funding transferred to industry was 32.5 Million YTL by the end of August 2005. Even though

the industry's share in total amount of funding was ranked as third at that time (budget used for TÜBİTAK institutes 48.6 Million YTL and budget used for academic R&D projects 34.5 Million YTL) but predictions for by the end of 2005 was presented as 116 Million YTL and which would be the biggest share of total R&D budget.

SCST indicates some important changes in the design of Industrial R&D Grant Programme and points out two major recent developments in the programme: First change was the regulation of the programme which was published in Official Gazette on 13th of July 2005. New regulation first changed the name of the programme as Industrial R&D Projects Funding Programme and put in force several major changes to facilitate evaluation and monitoring process including introduction of funding contract, the possibility of advance payments and financial examination of the projects by chartered accountant. Another major change in the programme was the change of the composition of the funding source. Projects supported by the programme have been funded by DTM from the Support and Price Stability Fund (DFIF) whereas, after the huge increase of the budget of TÜBİTAK, a protocol was signed between TÜBİTAK and DTM on 1st August 2005. According to the protocol, 75% of funding would be covered from TÜBİTAK's budget and the remaining 25% would be covered by DTM respectively. (SCST, 2005b)

Brief information was provided in the meeting that DFIF source was earmarked to TTGV to fund R&D projects. Very interesting statement appears in the minutes of the meeting: It was declared that 104 project applications have been sent SANTEZ Programme[5] which aims to fund graduate thesis jointly developed by academia and industry. Added that these applications were forwarded to TÜBİTAK by Ministry of Trade and Industry and 79 of them were found as eligible and their evaluation procedure had been already started. This resolution can be regarded as late announcement of SANTEZ Programme which aims to encourage graduate student who would like to work on the industry's problems in their graduate study.

As a new decision, SCST selects several internationally recognized indicators from OECD Science and Technology Indicators, EU Trendchart on

[5] SANTEZ is the abbreviation of Industrial Thesis

Innovations, World Development Index, World Competitiveness Report and sets new targets for selected indicators.

Also, SCST raised the issue of participation of EU 7th Framework Programmes and designated TÜBİTAK as the responsible institution with Ministry of Foreign Affairs, State Planning Organization, (Turkish) General Secretariat of EU.

3.2.13. 13th Meeting

13th SCST meeting mainly concentrated on the reflections of developments related Industrial R&D Funding Programmes and number of project applications, number of applicants (firms) and total amount of funding in years was presented respectively. Table1 shows the overview of recent performance.

As different from Industrial R&D Funding Programme, the council added some remarks on TTGV's role in supporting of industrial R&D activities in national innovation system. Especially, seed capital funds and incubator funds were mentioned as important tools for promotion of entrepreneurship in universities. Moreover, SANTEZ Programme mentioned again as an alternative opportunity to direct students to priority areas.

Table 1 – Industrial R&D funding Programme 1995 - 2005 (Source: SCST, 2006a)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Number of Project Appl.	121	274	266	271	251	260	333	374	418	503	575
Number of Firms	50	145	182	173	178	176	233	269	316	360	434
Number of New Firms	50	130	140	113	102	99	130	154	192	230	254

This meeting introduced a new support tool for patenting activities of researchers thanks to the agreement between TÜBİTAK and TPE. TÜBİTAK was planning to provide two options for researchers. First option would only cover expenses of national patent applications and certain amount of the expense would be covered as a grant and payments would be transferred to only TPE's account. In the second option, soft loans would be provided to the applicant who would like to apply for triadic patent.

Applicants of both options would be evaluated by a committee including representatives of TÜBİTAK and TPE and the amount of support would be determined by Science Board of TÜBİTAK.

Also, in line with the strategy adopted in 10th SCST meeting, government transferred 415 Million YTL (New Turkish Lira) to TÜBİTAK for 2006 to be used for funding of R&D activities. (SCST, 2006a)

14th SCST meeting has largely devoted to updated statistics showing Turkish STI performance and they are showing that Turkey's performance has been improving steadily which can be seen in the following chart.

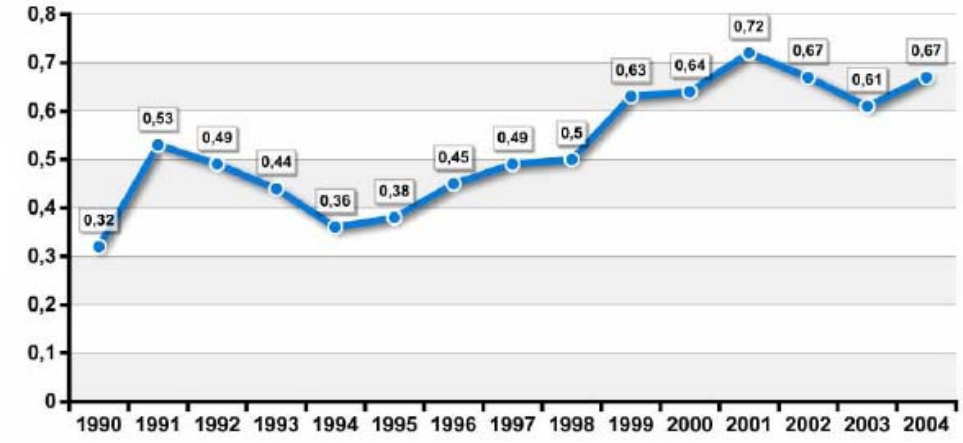


Figure 8 – Change in GERD as a percentage of GDP (Source: SCST, 2007a)

Apart from general statistics, overall statistics and figures showing recent figures of Industrial R&D funding Programme point out that number of project applications, number of applicants and amount of funding have been increasing.

A report on TÜBİTAK's preparations for 7th Framework Programme was presented to the council and Turkey's intention to participate the Programme was expressed in the minutes of the meeting. (SCST, 2007a)

3.2.14. 15th Meeting

SCST announced change in legislations regulating Industrial R&D Funding Programme (Prime Ministry, 2007a) to support the following activities of the firms without making any discrimination about its size and sector in order to increase their competitive power:

- Project based research, technology development and innovation activities
- To promote technology and innovation oriented collaborations and technology transfer mechanisms between firms and research institutions
- To support entrepreneurship based on research, technology development and innovation
- To support dissemination activities on research, technology development and innovation
- To support sectoral and/or regional research, technology development and innovation activities in line with technology priority areas

After changing legislations, new regulation documents were published to make fine-tuning in the programme. However, there was apparent rise in number of applications, number of applicants and total amount of funding. For example, number of project application rose from 595 in 2005 to 711 in 2006 and number of firms and other figures are gradually improved in a year.

TÜBİTAK decided to implement two new funding mechanisms to diversify its funding instruments for industry by providing customized funding mechanisms for two major target audiences. These instruments are:

- SME Funding Programme
- Techno-entrepreneurship Programme

SME Funding Programme aims to support SMEs who has not yet received funding TÜBİTAK's programme or received funding at least one. TUBİTAK promised to fund projects with a maximum grant ratio, 75% of all eligible R&D costs whereas budget of SME projects in this programme is limited to 400.000 YTL and duration of the project is restricted to 18 months

Techno-entrepreneurship Programme offers similar support for young entrepreneurs but a major difference in the programme is type of eligible costs which includes office expenditures, communication expenses and other costs such as electricity, heating and etc. However, the programme

is only open for entrepreneurs who hold an undergraduate or graduate degree for less than 5 years.

As a different from project based support mechanisms, TÜBİTAK decided to foster sectoral cooperation to determine future R&D priorities and come around a strategic vision of all stakeholders. European Technology Platforms inspired TÜBİTAK to initiate this mechanism because, European Technology Platforms are acting as R&DS community representing a specific sector which was composed of industry, universities, and research institutes NGOs. It was thought that similar sectoral organizations would be beneficial in national level. TÜBİTAK paved the way for establishment of national technology platforms by creating a specific support mechanism for platform type sectoral gatherings and give an impetus to several sectors to come around a shared vision with the active guidance provided by TÜBİTAK. Hence, the following sectors were selected at the beginning:

- Electric and electronics
- Textile
- Automotive
- Metallurgy
- Marine

TÜBİTAK organized a general information day for initiation of national technology platforms and then let each technology platform to organize its own meeting and to work on their own resources to create national technology platforms.

In addition to its coordination efforts, TÜBİTAK launched a new programme named as İŞBAP[6] in which will provide co-funding of such initiatives if a group of companies and relevant sectoral initiatives come together to establish long term cooperation in order to determine its R&D priorities, strategic research agendas and cooperation possibilities.

Among the other decisions, a tiny but significant decision appears in the minutes of the meeting. It is the first time that SCST express the importance of impact analysis of publicly funded research, development and innovation activities which makes the rationale for the usage of public

[6] İŞBAP is the abbreviation of Initiative for Setting up Cooperation Networks and Platforms

money accurately. Stated that an evaluation study on industrial R&D funding will commence in 2007

3.2.15. 16th Meeting

In this meeting SCST drew attention of increase in the performances of technology and innovation funding programmes presented updated predictions 2007. Council announced that newly launched SME funding programme and Techno-Entrepreneurship Programme has received many applications whose effect will be visible in this year's overall results.

SCST appreciates the increase in number of project proposals but claims that most of the applicants are having financial problems so it was observed that projects last longer than it was planned and most of them reduced its scope because of financial problems. Therefore, it was decided to raise minimum funding ratio to 50% for all firms from the previous value of 25% for large companies and 32% for SMEs. Another important milestone for industrial R&D funding is implementation of advance payment for all firms. Firms can receive up to 40% of its planned expenses for the next terms as advance payments provided that they provide required letter of guarantee.

SCST announced a new programme for international R&D projects which was previously accepted by Industrial R&D Funding Programme. This programme was specifically designed for EUREKA, EUROSTARS and other international programmes and combined benefits provided by Industrial R&D Funding Programme and SME Funding Programme.

SCST presented updated figure and payment data for Patent Support Programme which clearly shows that more than 300 applications has received and approximately 960.000 YTL was transferred to applicants.

SCST also reports that national technology platforms continue its activities and each platform has already selected its steering committee and started to construct its vision and mission and each of them is currently working on preparation of strategic research agenda. Furthermore, three additional sectors were selected to proceed with the creation of technology platform and TÜBİTAK bring all relevant actors together for these sectors and initiated the creating of national platform. These are:

- Medicine
- Energy
- Agriculture

It was reported that these efforts inspired other sectors and construction sector gathered and to take the initiative as a national technology platform. (SCST, 2007b)

3.2.16. 17th Meeting

17th SCST mainly presents recent developments in Turkish research landscape and only two new decisions were announced in this meeting.

The overview of developments starts with TÜBİTAK's patent support programme and the increase in number of applications was underlined. According to the council 1155 patent applications are expected in TUBİTAK's patent support programme in 2008 where 762 applications have received from the beginning of the programme.

SCST also summarized results of industrial R&D support programmes and draw attention to rise in number of application to all programmes. It is announced that Industrial R&D Funding programme received 809 project applications in 2008 and number of applications to SME funding programme and Techno-Entrepreneurship programme are 578 and 99 respectively. Apart from the summary of figures, it was pronounced that online application system was implemented for Industrial R&D funding programme in February 2008.

SCST also expressed appreciation of the adoption of new R&D law and declared that new law will positively contribute to competitiveness of Turkish economy by facilitating R&D activities; collaboration between firms, foreign direct investment based on R&D. Key properties of new law is also summarized in this meeting[7]. SCST announces that preparation of new regulation is still being prepared by Ministry of Finance and Ministry of Industry and Commerce.

Recent studies of technology platforms also summarized in SCST where electrics-electronics and automotive technology platforms have applied for

[7] Since new R&D law will be discussed in Section 4.7, further details are not presented here

İŞBAP programme to get funding from its activities. Other platforms are still in preparation stage.

In addition to these developments, Turkey's recent performance in 7th Framework Programme is also summarized and a separate progress report was submitted to the council.

As new decision, SCST first announce rules regarding distribution of government R&D funding to be applied for all programmes and projects. Rules adopted in 11th SCST are applied for the years between 2008 and 2010 and it was declared that aim is to support projects which will arouse R&D potential of Turkey.

The second new decision is related to gross expenditures on R&D whose ratio of GDP slightly decreased in 2007 compared to 2006. For this reason SCST published an estimation of budget need to attain %2 target adopted in 10th SCST for 2013. SCST estimated that State Planning Organization, SPO has 24% share of direct government funding, and Scientific Research Programmes undertaken by universities has a share of 28% and TÜBİTAK's share is 39% (SCST, 2008). Therefore, SCST asks government to allocate necessary budget to TÜBİTAK and other related institutions to attain 2% target for 2013.

3.3. Overview of All Resolutions

Since SCST is the highest body in Turkey responsible for policy formulations and recommendations on science, technology and innovation, its resolutions covers different aspects of STI issues. However, this document aimed to summarize only resolutions related to industrial R&D policies and tried to reflect them sequentially.

Separate summary of each meeting is beneficial to comprehend unique conditions, problems and needs of each time period and reveal policymaker's perspective at that time. Moreover, it helps readers to trace changes hence, the needs and trends in Turkey over time. When all meetings are scrutinized from this perspective several important observations appears.

When each meeting is compared in historical context, changes in the content of the resolutions provide an interesting result: Resolutions of past meetings was quite far from decisive and conclusive statements and minutes of the

meetings looks like a position paper which analyses current problems associated with science and technology issues and suggest some policy recommendations at the end. This result is quite apparent when targets for some indicators are under consideration. For example, past meetings barely contains performance measures and even some measures were introduced or presented in the minutes, they stand alone among the other resolutions because they were not associated with clear definitive policy action. Such weakness in council's decisions may be explained with discontinuities in political commitment because there were frequent changes in political landscape at that time (in 1980s and 1990s) which may prevent strong and continuous commitment to formulation of science and technology policies.

Although past meetings were lack of political commitment resulted with weak policy recommendations, decisions and resolutions addresses wider group for example most of resolutions designate formation of workgroups to work on identified problem and to propose policy recommendation. Therefore, first meetings depicts broader picture of innovation system and forces other institutions to act in accordance with council decisions.

Latest meetings differ from the earlier ones in terms of the scope and the content of the agenda and the clarity and the functionality of the decisions. In order to compare recent meetings with the previous ones, it should be noted that recent meetings follow routine and continuous schedule in contrast to the previous ones which show a strong political commitment behind the council and science and technology policies.

Such strong commitment behind the council can be traced from the clear and decisive voice in all resolutions. As different from past meetings, decisions presented in a concrete way and mostly supported with a clear background analysis of the status-quo. Similarly development on the decisions adopted in previous meetings was mostly presented with detailed figures which allow tracing of backward or forward advances.

CHAPTER 4

INDUSTRIAL R&D FUNDING IN TURKEY

In 1990s Turkey's economic integration with European Union and the rest of the world has increased its speed and because of that; direct and indirect subsidies were restructured in accordance with rules and regulations imposed by international agreements. Especially Turkey's membership to World Trade Organization (WTO) paved the way for development of new incentives for private R&D in order to replace direct subsidies.

It was that time which existing institutional setting started to evolve and thereby Technology Development Foundation of Turkey was founded at the beginning of 1990s with the aim of providing financial incentives to industry and promotion of industrial R&D. Similarly, Small and Medium Sized Industry Development Organization (KOSGEB) was established in 1990 to support Small and Medium Sized Enterprises (SMEs). A few years later, TÜBİTAK implemented industrial R&D funding programme, and a separate directorate was established in 1995 as a complementary to TTGV funds.

Starting from 1990s, only these three major institutions, TÜBİTAK, TTGV and KOSGEB offered incentives for companies undertaking R&D activities however, R&D supports diversified in 2000s and some new R&D programmes were offered by Ministry of Industry and Commerce, Ministry of Agriculture and Rural Affairs, Under-Secretarial of Defense Industry as well as new or revised programmes of TÜBİTAK, TTGV and KOSGEB. These institutions provide project-based R&D incentives to industry but there are some support measures such as technology development regions, tax exemptions for R&D expenditures which offers different advantages to companies having R&D investments or R&D expenditures.

For example, "Regulation Regarding Implementation of Technology Development Regions" was published in official gazette on 19th of June 2002. This regulation provides several advantages to firms having offices in technology development

regions (TDR) who are engaged in R&D. Revenues generated from R&D activities within TDRs are excluded from income taxes and corporate tax until 31th of December 2013. In addition wages of researchers, software developer and other R&D personnel is free from income tax until the same date. In addition to tax exemptions, regulation enables academicians to work for firms in TDRs upon the permission of university. Academicians can also establish their own firms within TRDs without leaving from their university. (Prime Ministry, 2002)

Although this regulation has many advantages in addition to these mentioned above, other benefits and advantages will not be discussed in detail because, this section is entirely devoted to project-based industrial R&D support mechanisms. Therefore, related programmes of the following institutions will be explained in the next section:

- TÜBİTAK
- TTGV
- KOSGEB
- Ministry of Industry and Commerce
- Ministry of Finance
- Ministry of Agriculture and Rural Affairs

4.1. TÜBİTAK's Industrial R&D Support Programmes

There is a phrase in the mission statement of TÜBİTAK which states that supporting and conducting of research and development activities is the main concern for TÜBİTAK. In line with its mission, TÜBİTAK has been managing one of the main industrial R&D funding instruments of Turkey. Starting from 2007 TUBİTAK launched three direct R&D support programme which are, SME Funding Programme, Techno-Entrepreneurship Programme and International R&D Funding Programme and one indirect project based programme, İŞBAP directed to supporting of collaboration platforms. The following section is dedicated to brief introduction of each programme.

4.1.1. Industrial R&D Projects Funding Programme

Industrial R&D Project Funding Programme is the second oldest industrial R&D funding mechanism which has been jointly managed by Under-Secretariat of Foreign Trade (UFT) and TÜBİTAK since 1995. The programme aims to improve R&D capability of Turkish companies.

The programme is open for project applications from any firms regardless of size and sector of the firm. TÜBİTAK covers at least 50% of all eligible R&D costs and grant ratio can be increased up to 60%. Funding ratio is independent from size and sector of the company; on the other hand it depends on performance criteria of the firm, priority technology areas and number of personnel having PhD degree. More detailed explanations on the conditions of grant ratio will be discussed in Section 5.1.

There is no limitation on budget of projects but duration of projects is limited to 3 years.

The following expenses can be supported within the programme:

- Conceptual development
- Technological, technical and economic feasibility studies
- Laboratory studies or other studies need for transition from conceptual design to development
- Design, design verification and implementation
- Production of prototype
- Establishment of pilot plant
- Trial production
- Patenting and license studies
- Studies on the problems detected after sales of the products

Almost all direct expenses needed for aforementioned R&D activities which are discussed in Section 5.1 but to sum up, ranging from personnel expenditures to equipments, instruments and direct materials are supported within the programme.

Project applications first assessed by external evaluators and their assessment reports then submitted to evaluation committees which give final decision on the project proposals. Detailed description of assessment will be explained in Section 5.1 in addition to monitoring and payment procedures.

4.1.2. SME Funding Programme

Based on new decree announced on 16th of October 2007 regulating TÜBİTAK's Industrial Research-Development, Technology and Innovation Supports, SME Funding programme was launched by TÜBİTAK in April 2007.

The programme is only open SMEs who have not applied for TÜBİTAK funding before and it is targeted to support only first two R&D projects of them.

Another limitation is imposed on the budget of the projects to be submitted to the programme which restricts maximum budget as 400,000 YTL. In addition, rules state that duration of the funded projects cannot exceed 18 months. Even though the programme puts some restrictions, it introduces extra benefits as a different from main Industrial R&D Project Funding Programme. Support ratio of all eligible R&D expenses is 75% which is the highest level of R&D funding imposed by EU legislation for industrial research activities of medium sized enterprises. (European Commission, 2006:14) In addition to favorable grant ratio, programme also covers consultancy expenses needed for project management and preparation of project application documents with a maximum limit of 20,000 YTL per project.

Except for aforementioned limitations and additional favors, application, assessment and monitoring process of the projects are totally same as Industrial R&D Project Funding Programme.

4.1.3. Techno-Entrepreneurship Funding Programme

Techno-Entrepreneurship Programme was launched at the same time as SME Funding Programme. The aim of the programme is to support young entrepreneurs with an innovative project idea having high commercial potential. Only senior university students or fresh graduates of B.S., M.S or PhD programmes whose degree is less than 5 years old can apply for this programme.

The structure and aim of the programme is quite different from other industrial R&D programmes managed by TÜBİTAK. The programme has two-step application process. In the first step applicants submit very short document reflecting their project idea. If project idea is innovative enough and its potential is approved by TÜBİTAK, more detailed application document is requested from applicant. Second phase application includes detailed business plan in addition to standard information requested from each R&D project proposals.

Similar assessment procedure is applied to the techno-entrepreneurship application documents with some differences. The major difference is that applicants are invited to evaluation committee meetings in order to present their project ideas. Such favor does not offered to owners of R&D projects. Project monitoring and payment procedures are same as previous two programmes.

Even though there are similarities between Techno-Entrepreneurship programme and other two R&D funding programmes, funding conditions are different. There is no clear limitation on budget of project application like SME funding Programme bur this programme sets upper limit for TÜBİTAK funding as 100,000 YTL per project. Similarly TÜBİTAK covers 75% of all eligible R&D expenses which are almost the same as other programmes but in addition office and workshop rent expenses and internet and telephone expenses are regarded as eligible in this programme. Finally, TÜBİTAK states that funding is provided to the entrepreneur for 12 months with aforementioned conditions.

4.1.4. International Industrial R&D Funding Programme

International Industrial Funding Programme was launched in 2007 in order to support Turkish participants of international R&D projects. Programme is specifically addresses EUREKA and EUROSTARS programmes but it is also open for other international programmes announcing project calls like ERA-NET programmes.

The programme is simply a mixture of Industrial R&D Project Funding programme and SME Funding Programme because funding ratio provided to the companies depends on the firm size. 60% of eligible R&D expenses of large firms are supported while support ratio is increased to 75%. There is no limit for project applications and the amount of funding per project and no restriction is applied on duration of international R&D projects.

The major advantage of the programme is its openness to international evaluation of project proposals. Implementation regulation states that Turkish participant(s) of international project may not be evaluated by national experts if international project was previously evaluated and approved internationally.

4.1.5. Support Programme for the Initiative to Build Scientific and Technological Cooperation Networks and Platforms

Support Programme for the Initiative to Build Scientific and Technological Cooperation Networks and Programmes, in other words, İŞBAP is a new initiative launched in 2007 to support formation of scientific and technological cooperation among industry, universities and NGO's and government organizations. As its name implies, İŞBAP is directed to foster networking activities among various bodies to strengthen physical and intellectual R&D infrastructure, to motivate related actors to actively work on determination of strategic research agenda for their sectors/regions.

The programme provides project based support for networking activities of applicants and in order to apply for İŞBAP programme consortia should be formed including at least one company and university.

Support is provided to the consortia as a co-finance up to 250,000 YTL per year. In order to get support from TÜBİTAK, applicants have to prove that they allocated same amount of money for planned activities. In addition, support period for approved projects cannot exceed 3 years.

Since the aim of programme is different than other project based R&D supports of TÜBİTAK, supported expenses are mostly covers coordination activities such as:

- Expenses for meeting organizations
- Travel and accommodation expenses
- Expenses for office equipments
- Expenses for dissemination activities
- Expenses for consultancy services for IPR issues

4.2. TTGV's Industrial R&D Support Programmes

Technology Development Foundation of Turkey (TTGV) was jointly established by public and private sector in 1991 with the aim of promotion of national industrial R&D activities. The mission of TTGV is enhancing competitiveness of Turkish industry, at international markets, by supporting technological and innovation activities. TTGV offers several support programmes grouped into three major categories:

4.2.1. R&D Project Supports

4.2.1.1. Technology Development Projects

Technology Development Projects (TDP) is the oldest industrial R&D funding programme launched in 1991 with stimulus of World Bank loans. First phase of the programme covering years between 1991 and 1998 was executed by World Bank loan worth 43.3 Million US Dollars. (Taymaz, 2001:164) After 1998, TTGV started to use national resources provided by UFT indicated in the decree of Money-Credit Coordination Committee at June 1st, 1995.

TDP Programme aims to support innovative projects having "technological product" and "technological process innovation" as defined in OECD's Oslo Manual.

Supported activities is totally same with Industrial R&D Project Funding Programme of TÜBİTAK which is listed in the Section 4.1.1, and similarity between these two programmes implies that common funding source, UFT, has binding influence on both programmes. Correspondingly supported expenses are similar to Industrial R&D Projects Funding Programme.

The only difference in eligible expenses between Industrial R&D Funding Programme and TDP programme is that TDP Programme covers transportation and communication expenses of firms which are not covered by TÜBİTAK.

Even though two programmes are similar in nature, there is a major difference that TDP programme provide soft loans to eligible projects and maximum amount of funding cannot exceed 1 Million USD. In addition to this limitation, duration of the project is also limited to 2 years and companies have already got benefit from this support have to pay loan in 4 years starting one year later from the completion date of the project.

4.2.1.2. Commercialization Projects

This programme aims to support commercialization of new products or services developed by companies who previously benefited from TTGV's TDF programme and developed a successful prototype.

Commercialization Support is specifically designed to support companies' additional investments related their R&D based product or process developments. Eligible expenses are almost same as TDP programme expect that companies can use TTGV funding on marketing activities but this expense cannot exceed 20% of total budget of the project.

4.2.2. Support for Environmental Projects

4.2.2.1. Phase-Out of Ozone-Depleting Substances Project (PODS)

After the implementation of Montreal Protocol on substances that deplete ozone layer, in which Turkey took part in 1994, serious restrictions were imposed on industry to reduce production and consumption of ozone depleting substances (ODS). Since, it puts too much pressure on companies to maintain its competitive position in the market without having any economic loss; Montreal Protocol Multilateral Fund allocated a fund for Turkish industry via World Bank and TTGV as assigned as implementing body.

TTGV launched a programme in 1994 to encourage SMEs to develop alternatives to enhance a smooth transition to non-ODS using technologies. SMEs are not the only concern in the programme and TTGV aimed to support large scale project to reduce OSD in Turkish industry. The programme covered years between 1994 and 2007 and 151 companies have been supported in the programme with the total budget of 22.1 Million USD.

4.2.2.2. New Environmental Support Programmes

In 2006, TTGV launched three new programmes to diminish negative aspects of industrial production on nature and to help Turkish industry to implement environmentally friendly technologies by preserving their competitive position in the market. There are three different programmes available:

- Renewable Energy Support Programme
- Energy Efficiency Support Programme
- Environmental Technologies Support Programme

Although all programmes have different aims, they provide applicants same benefits for their projects which are summarized Table 2 below:

Table 2 - Key Properties of Environmental Projects Support

Target Audience	• Industrial companies which use energy intensely in their processes or develop renewable energy technologies. • Industrial companies which use energy intensely in their processes. • Industrial companies having energy intensive and waste producing processes.
Maximum Duration of Projects	18 months
Size of the Project	Minimum 100,000 USD, maximum 1 Million USD
Support Type	Loan
Support Rate	Not more than %50 of project budget
Bay-Back Period	1 year grace period, total 4 years after project completion–no-interest

4.2.3. Technological Entrepreneurship Supports

4.2.3.1. Pre-Incubation Support

Pre-Incubation support targets entrepreneurs who have an innovative idea but haven't established their business. Moreover, entrepreneurs' ideas should have high growth potential and they should turn out to be qualified for Start-up or Risk Sharing Facility Support Programmes.

When a business idea is submitted to TTGV, it is first evaluated in terms of its relevance to TTGV's business scope. If it is eligible, TTGV holds face-to-face meeting with entrepreneurs and decide whether to support him/her or not. If decision is positive, support for the following activities will be provided by TTGV up to 50,000 USD:

- Use of TTGV's incubator offices
- Direct cash support
- Access to external expertise
    - Financial expertise
    - Business model development

    - Technology assessment
    - Market analysis
- Technical support (Access to required expertise, laboratories, equipments, etc.)
- Consultancy Services (Management, accounting, law)

Depending on scope and type, support duration varies between 8 months to 16 months and cannot exceed 24 months.

If any outcome occurs at the end of support subject to IPR, TTGV owns 50% of IPR. But in case of entrepreneur pays tenfold of the support received, he/she owns whole IPR and TTGV has no claim on it. At the end of support TTGV may ask entrepreneur to continue with Start-up or Risk Sharing Facility Supports. If such option is not offered by TTGV, entrepreneurs have to pay back its support within a time limit specified on contract and then he/she owns whole IPR.

4.2.3.2. Start-up Support

Start-up support was created to assist talented entrepreneurs having creative, unique and advanced-technology ideas which turn out to be profitable business at the end. It is expected that ideas should target cutting-edge technologies and clearly prove its potential with presenting successful business model. TTGV pledges to provide up to 400,000 USD support in the form of equity capital to entrepreneurs.

4.2.3.3. Risk Sharing Facility Support

The aim of this support programme is to provide financial support to innovative and risky innovation and technology development projects on priority areas (such as, information and communication technologies, biotechnology, nanotechnology and etc.) determined by TTGV. This programme both targets young and small firms having small and risky R&D projects on new product/process development and entrepreneurs having a brilliant business plan as well as innovative project idea.

The scope of eligible activities and expenses is exactly as same as Support for Commercialization projects but size and condition of support differ from it. TGGV provides support a loan up to 200,000 USD without asking for guarantee/security from applicants to cover its 50%

of all eligible R&D activities. However, TTGV owns 50% of its outcomes subject to IPR at the end. If applicant would like to obtain its IPR back, he/she has to pay tenfold of the support immediately or pay back its support within the time limit specified in support contract.

4.3. Supports Offered by KOSGEB

As its name implies, KOSGEB was founded with an act numbered 3634 published on April 4th, 1990 in order to increase efficacy and share of SMEs in industry to raise their competitiveness. (Prime Ministry, 1990) In general, KOSGEB has many missions including, establishment of technology centers, science parks, consultancy centers and institutes to support R&D activities in industry; to promote, industry-academia collaboration, to implement consultancy services to increase the capability of industry and etc. Since its official duties are too diversified, its services and support programmes are also diversified enough to span whole industry.

KOSGEB offers various support programmes to SMEs on business development activities, replenishment of IT infrastructure, quality development activities, entrepreneurship as well as technology development and innovation. Among various support programmes only technology development innovation supports has strong emphasis on R&D.

KOSGEB's technology development and innovation supports are different from project based R&D funding whereas they are composed of different incentives targeted to support innovative ideas having a potential to be turned out new products and processes.

Only firms are being supported by the council responsible for the management of TEKMER[8] and Technology Incubators are eligible to get supports provided under this category and firms should meet SME criteria and in addition their number of employees should not exceed 150.

Mainly, two types of support are offered to the applicants, grants or soft loans which cover the following expenses:

- Direct R&D expenses for needed material and equipments and other costs for pilot run and prototyping
- Equipments required to increasing quality of products

[8] TEKMER is the Turkish abberviation of Technology Development Centers

- Expenses for consultancy services provided by universities which is needed for R&D activities
- Expenses for dissemination of R&D results: printing and or preparation of brochures, book, leaflets, CDs etc.,
- Support for office rents
- Allocation of work-shops for R&D and development
- Travelling costs needed for participation of international symposiums, congresses, technology fairs or other meetings in order to facilitate technology transfer
- Support for business development activities

Detailed explanations of each support measures including upper limit and support ratio can be seen from Appendix A.

4.4. Programmes of Ministry of Industry and Commerce

Ministry of Industry and Commerce is responsible for management of SANTEZ Programme[9] which aims to facilitate cooperation between industry and academia by supporting graduate studies in universities which turn out to an industrial project and has a potential to be implemented in the applicant firm.

Even though SANTEZ projects have two pillars, university and academia, projects are generally performed by researchers having graduate studies in universities therefore; university acts ac R&D performer and firm is beneficiary of the projects. Ministry of Industry and Commerce provides financial support to university and it is expected from firm to contribute financing of some of the R&D performed by university. Ministry covers 75% of expenses and industrial partner have to finance remaining 25% respectively.

The programme covers the following expenses:

- Machinery and equipment expenses
- Material expenses required for test or experiments
- Personnel expenses including project manager, thesis student, assistant researcher or other technical staff
- Travelling expenses required for data collections or on-site visits

[9] SANTEZ is the Abbreviation of Industrial Thesis in Turkish

- Expenditures for services requires for R&D project such as access to periodicals, standards, maintenance of existing equipments, transportation, etc.

Project proposals submitted to Ministry of Industry and Commerce and they are assessed by assessment committees. If decision is positive, a contract is signed between Ministry and all related parties then, funding process begins. Ministry and firm transfer the first 6 month's budget to the university and researchers starts planned activities. Progress reported to the Ministry in each 6 months and if project continues without any problems, payments of the next period transferred to the university.

4.5. Supports of Ministry of Finance

Ministry of Finance offers tax exemption for R&D expenses of companies. Ministry of Finance manages this support via its Revenue Administration Department. According to the decree numbered 25733 published in official gazette on 20th of February 2005, companies undertaking any activity subject to R&D tax exemption by %40.

R&D activities which are eligible for tax reduction are totally compliant with definition of R&D activities in Frascati Manual. However, covered R&D expenses are wider than eligible R&D expenses accepted in TÜBİTAK programmes. Indirect R&D expenses such as financial expenses, depreciation rates and other overhead expenses are also regarded as eligible for tax deduction.

A firm who would like to benefit from tax deduction first applies for Revenue Administration Department with a form describing its project idea and indicate total budget of the project. After pre-screening of the request, Revenue Administration Department forwards application to TÜBİTAK to evaluate technical aspect of the project. At the same time GİB ask company to pay service fee to TÜBİTAK for processing of its application. TÜBİTAK processes the application by using external evaluators from academia and similar procedure which is applied in other TÜBİTAK industrial R&D project applications are also followed in this process. If external evaluator indicates that activities presented in application document has R&D content, firms are informed that they can write declare reduced tax in corporate tax return sheet.

4.6. Programmes of Ministry of Agriculture and Rural Affairs

Ministry of Agriculture and Rural Affairs implemented a support mechanism for those undertaking R&D projects on agriculture. A separate directorate, General Directorate of Agricultural Research (TAGEM)[10], within the ministry manages and implements R&D programme in accordance with the decree numbered, 26657 published on September 28, 2007. (Prime Ministry, 2007b)

The aim of this support programme is to fund R&D project in priority areas defined by ministry and accordingly it is stated that each year ministry has a right to define priority research areas. As a different from other industrial R&D programmes, this programme is open for companies, universities, craft organizations, non-governmental organizations, and individuals.

TAGEM asks about technical managerial and financial details of project application in a very simplified format and similar to other programmes, all applicants are subject to the following criteria during evaluation process:

- Project's relevance to priority areas set by ministry
- Project's relevance to policies of the ministry and its applicability
- Expected impact of the project and its implementation potential
- Its technology development potential
- Research capability of applicant, the knowledge level and capability of its R&D personnel, its research infrastructure
- Exploitation of existing resources
- Coherence of project budget with planned activities

Although, clear measure on evaluation of project proposals and evaluation criteria are presented in a comprehensive way, some details on type, duration financial of support of the programme are missing in all legal and public documents. However, it is stated on the webpage that 7 projects was decided to be funded among 37 applicants on December 6th 2007.

4.7. New R&D Tax Incentive Law

Since sustainable long term economic growth depends on the competitiveness of the economy, investment on R&D, technology and human capital is getting as important as physical capital. Taking this fact at the forefront, new R&D

[10] TAGEM is abbreviation of General Directorate of Agricultural Research in Turkish

law envisages providing new incentives to firms undertaking R&D. The expected benefits of the law are listed as follows:

- To achieve sustainable economic growth
- To increase competitiveness of economy by supporting R&D activities
- To increase the share of R&D expenditures in GDP
- To increase the production of high added value goods and services
- To decrease production costs by increasing productivity
- To support employment of researchers and high quality personnel
- To encourage employment of Turkish researchers who are living abroad
- To attract foreign direct investment related to R&D
- To encourage collective R&D

First, the law defines R&D centers as "A separate R&D units within a firm established in accordance to Turkish laws who are employing more than 50 full time equivalent researchers". Pre-competition cooperation research projects are also re-defined as "cooperation of more than one firms on a single project targeted to develop new processes, systems and applications in order to develop common equipments, systems or platforms which will be commonly used by all firms". Another definition explains techno-entrepreneurship (seed) capital "the seed capital will be given to young entrepreneurs who graduated from universities or graduate school at most 5 years ago and having innovative project idea which has high potential to turn out to be high-added value". The law provides following advantages for firms having R&D centers or involved in collective research projects or young entrepreneurs:

- R&D and innovation expenditures of firms can be deducted at a rate of 100% from the corporate income tax base[11]. In addition to this, firms with a separate R&D Center including more than 500 R&D personnel can deduct half of the increase in R&D expenditures with respect to the R&D expenditures in the previous period.
- Income tax collected from salaries of employees is also subject to deduction. %80 of salary income of R&D or support personnel is exempt from income tax. However, rate is increased to %90 if R&D or support personnel have PhD degree. The total amount of support personnel

[11] Tax deduction on R&D expenses of these firms was %40 before implementation of new R&D law.

benefiting from the income tax exemption cannot exceed 10% of the total R&D personnel.

- Half of the employer portion of social security premiums of the R&D and support personnel will be funded from the budget of Ministry of Finance for five years. Social security payments of civil servants are out of scope of this law.
- Documents prepared for R&D activities which are described in the law are exempt from stamp duty.
- Seed capital support is given to entrepreneurs whose characteristic are described above without asking any letter of guarantee. This support cannot exceed 100,000 New Turkish Liras per entrepreneur and an entrepreneur can receive this support only once. The total budget which will be used by government institutions cannot exceed 10 Million New Turkish Lira for per year.
- A new obligation is set for firms involved in pre-competition cooperative research projects whose characteristics described above. Firms involved in cooperative project have to open a bank account for their project-based expenses and money transactions are not regarded as income for account owner and exempted from income tax.

Remarkable tax deductions are provided to firms established in technology centers (TEKMER), having R&D centers in accordance with definition in the law or firms having R&D projects being funded by governmental institutions or non-governmental organizations or foundations or international programmes. R&D or support personnel described in the law are those working in R&D projects are being done by aforementioned firms. (Prime Ministry, 2008)

The law only points out general framework and does not give any detail on the implementation of tax incentives however; Ministry of Finance and Ministry of Industry and Commerce are addressed as main implementing bodies. It was declared that related rules and regulation would be prepared by these ministries with TÜBİTAK's comments and opinions.

4.8. Overview of Industrial R&D Supports

As depicted in previous sections TÜBİTAK, TTGV, KOSGEB, Ministry of Finance, Ministry of Industry and Commerce and Ministry of Agriculture and Rural Affairs are main institutions in national innovation system implementing industrial

R&D funding. Although each programme is introduced individually, consolidation of the explanations is needed to see the broad picture.

R&D support mechanism implemented by Ministry of Agriculture and Rural Affairs is only directed to the firms operated on agriculture and hence the scope of the support is very limited. The impact of the programme is limited because it is restricted to a specific sector.

Similarly SANTEZ programme managed by Ministry of Industry and Commerce only targets technology based firms who are capable of implementing solutions developed by graduate students. Firms willing to apply for this programme have also to be competent enough to determine their problems and R&D needs and present them to by preparing very detailed project application document. Although the programme looks very promising, it requires close cooperation between applicant firms and university. In addition, firms have to be willing enough to work with PhD or M.S. students and open enough to implement their solutions.

KOSGEB provides several incentives to SMEs to encourage them to do more R&D. However, it provides various services to SMEs such as business development, marketing, improvement of IT infrastructure. Although services and incentive offered by KOSGEB designed by taking into account of SMEs, implementation of R&D support programmes are very bureaucratic compared to other R&D support programmes. Another drawback is related with diversity in support programmes. Since KOSGEB offers various support programmes, some of which point out same problems and provide similar solutions, SMEs feel very complicated to choose best opting among various offerings.

Tax incentives managed by Ministry of Finance is open for all firms however, only large firms are aware of such facility and they are extensively using tax incentives. Nevertheless, this scheme is not popular as other programmes and only 258 applications from 59 firms were received in 2007.

TÜBİTAK and TTGV are the oldest actors in national innovation system and accordingly they are managing two oldest industrial R&D funding instruments. TÜBİTAK's Industrial R&D Project Funding Programme and TTGV's Technology Development Projects Programme are most prominent programmes in Turkish research landscape and they both aim to fund new product and process development activities of firms.

Even though, there have been some problems in the execution of these programmes, total amount of funding, number of applications of these programmes are increasing year by year which clearly demonstrate the importance of the programmes in national innovation system. Empirical arguments are presented in various platforms which underline positive impact of these programmes in Turkish economy but systematic approach is needed for evaluation of the impact of the programmes.

CHAPTER 5

EVALUATION OF INDUSTIAL R&D PROJECT FUNDING PROGRAMME

As briefly outlined in Chapter 4, Industrial R&D Funding Programme is the most prominent instrument compared with other industrial R&D funding instruments in Turkey. Its importance not only comes from its presence in the last 13 years in national innovation system, but also it welcomes all firms from any sector. The importance attributed to the programme can be clearly traced from resolutions adopted in SCST in historical context where latest meetings continuously present increasing numbers related to the programme. Therefore, it is obvious that evaluation of such an important programme is an indicator of business R&D climate and industrial R&D policies because the programme is one of the prominent and the oldest R&D funding instrument in Turkey.

This chapter focuses on pilot scale evaluation of the programme in line with the literature survey outlined in Chapter 2. The main aim of this study is first to draw a logical framework for the implementation of programme-wide evaluation practice, to test evaluation methods and so as to see their applicability to Turkish case and based on the results of such pilot scale evaluation practice, it aims to present preliminary results which will give a signal to relevant community for further studies and to derive suggestion for further research attempts.

Having this aim, this chapter first introduces the programme in detail by presenting it starting from policy background and then project application, assessment of applications and funding procedures will be reflected consecutively.

Afterwards, evaluation approach will be discussed on two main subtitles: First selected evaluation methodology will be explained further and then available data and additional data collection activities will be described. The last section in this

chapter will be entirely devoted to data analysis. After presenting research questions, the analysis will be elaborated at the end.

5.1. Design of the Programme

The programme was launched in 1995 with the decree of Money-Credit Coordination Committee numbered 22300 published on June 1, 1995. But prior to the announcement of the decree, Decision of Council of Ministers points out the implementation of R&D grants in fully accordance with GATT rules and regulations. Decisions also addressed Money and Credit Coordination Committee for the implementation and Under-Secretariat of Foreign Trade (UFT) for the management of the law. In addition, Support and Price Stability Fund (DFIF) was appointed as a funding source. (Council of Ministers, 1995)

A protocol between TÜBİTAK and UFT was signed to launch a joint programme for supporting of R&D projects in 1995. Accordingly Technology and Innovation Funding Board (TİDEB) was established by TÜBİTAK in 1995 to manage this joint programme. The protocol states that R&D Grant Programme[12] was created with the following objectives (Gök, 2005:47):

- to share risk doing in R&D project
- to increase in-house capability in design of new products and processes
- to increase percentage of industrial R&D expenditure in Turkey
- to deepen and widen R&D culture in industry
- to promote industry-university cooperation
- to promote employment of qualified people (especially with a PhD degree)
- to maximize the use of advanced technologies in traditional manufacturing
- to assist SMEs managing their projects effectively
- to promote R&D in the priority technology fields
- to bring together the separate but related knowledge bases (networking) in generating technology specific competencies
- to open up new scopes to industry becoming competitive

In order to achieve aforementioned targets programme was designed to serve any companies creating added value in firm level including the ones engaged

[12] The programme was renamed as Industrial R&D Projects Funding Programme in 2006

in software development. There is no sectoral discrimination and project applications from any sector are welcomed in the programme. However, funding ratio is increased by 20% if project targets the following technological areas:

- Information and communication technologies
- Flexible manufacturing
- Advanced material technologies
- Biotechnology and genetic engineering
- Aerospace and aviation technologies
- Environmentally friendly technologies

As it can be inferred from the previous statement, there is no single funding ratio for all applicants; it changes according to characteristics of R&D projects. Minimum funding ratio for all projects is 50% of all eligible R&D costs and the maximum ratio is 60% respectively. Thus, there is additional 10% grant provided to firms under certain conditions. Firms are rewarded by additional 10% grant if their project meets the following criteria.

If the share of revenues generated from innovative products to total turnover does not exceed 25%, funding ratio of the firm is increased by 10%, if the share lies from 25% to 50%, funding ratio is increased by 15% and if the share is greater than 50%, it is increased by 20%.

Another criterion for getting additional funding depends on the location and the R&D personnel of the firm. If firm fits SME definition of Ministry of Industry and Finance, 75% of its personnel expenditure can be funded by TÜBİTAK, if it is located in science parks or technology incubators 90% of its personnel expenditure is covered but if the firm does not meet these criteria, its personnel expenditures are funded by 60 %. However, expenses of personnel having PhD degree are fully covered within the programme.

Last criterion for having additional grant is applied when firm acquires extramural R&D in the project. If firm conducts some of its R&D activities in science parks or acquire R&D service from universities, TÜBİTAK institutes or other firms located in science parks, grant ratio applied to these expenses is increased by 30%.

Even though there exist several conditions available for getting additional grant, the grant ratio applied to any project cannot exceed to the upper limit which is 60% of all eligible R&D cost of the project.

Since the programme is oriented to support R&D activities conducted by firms, activities related to product and process innovations are regarded as eligible and the ones required for marketing and organizational innovation are excluded. Therefore, eligible expenses are listed regulations on implementation of the programme as follows (Science Board, 2006):

- Conceptual development
- Technological, technical and economic feasibility studies
- Laboratory studies or other studies need for transition from conceptual design to development
- Design, design verification and implementation
- Production of prototype
- Establishment of pilot plant
- Trial production
- Patenting and license studies
- Studies on the problem detected after sales of the products

Only direct expenses strongly related to the activities listed above are regarded as eligible and the following expenses are covered within the programme:

- Personnel expenditures
- Travelling costs of personnel or consultants
- Expenditures for equipment, instruments and computer software
- Expenditures for materials directly necessary for project
- Expenditures for consultancy services or other services needed for R&D activities
- Expenditures for extramural R&D conducted by universities, TÜBİTAK's institutes and other public or private research organizations and other consultancy expenditures needed for R&D project
- Expenditures for patents and registration of industrial designs

Although almost all direct expenses are listed here as eligible, there are some limitations in funding. For example, equipments and instruments to be used in

routine production processes after the completion of R&D projects are supported with lower grant ratio which means that only depreciation of these expenses are supported within the duration of the project.

A short summary of general rules and regulations are reflected up to here, but in addition to them, programme has some distinctive features in application, assessment, funding and monitoring of projects which will be scrutinized in the following two sub-sections.

5.1.1. Application Process and Assessment of Proposals

As outlined in previous section all firms can apply for the programme without any limitation or restriction which means that one firm can send many applications at a time and can get funding from TÜBİTAK for their different R&D projects at the same time.

Firms can apply for funding by preparing application document coded as AGY100-03[13]. Number 03 shows the version number of the document and for the sake of simplicity document will be mentioned ad AGY100 hereafter. Simply AGY100 is composed of five main parts, each of which addresses different aspect of the project.

First section, Section A, contains basic information about the project which gathers information from firms on start and end date of the project, its cumulative budget and technological domain. This section also contains some key indicators of the applicant firm such as number of total and R&D personnel of the firm, turnover, turnover generated by innovative products and R&D expenses of the firm.

Section B questions technical content of R&D project and the emphasis is mainly directed to the explanation of methodology to be adopted during the execution of the project and it is expected from firm to clearly reflect the work to be done in pre-defined R&D steps which is listed in regulations on implementation of the programme. This section also asks innovation potential in relation with state-of-the-art of technology and firm's unique contribution to it.

[13] AGY100-03 can be accessible from the following web address: www.tubitak.gov.tr/tubitak_content_files/TEYDEB/1501/basvuru/AGY100-03.doc

Section C addresses organizational aspect of the project and contains project plan, organization the firm and project team including curriculum vitas of each personnel as well as work package definitions. It is also expected from firm to clearly demonstrate its R&D potential and research capability.

Economic feasibility of the project and the economic potential of the end product are questioned in Section D. A set of questions are also directed to unveil the impact of the project in national level so that its impact on other sectors, any networking and collaboration impact especially addressing collaboration between university and industry are examined in detail. Moreover, dissemination of the outcomes, protection of intellectual property rights and patent strategy of the firm are also asked in this part.

Last section is for see budgeting of the project and its distribution under pre-defined cost categories and costs spanning during the project.

After getting such detailed application document, project application is subject to pre-screening which is done by TÜBİTAK experts. Pre-screening is done in two steps: In the first step, TÜBİTAK expert checks project application in terms of its compliance of rules, regulations and pre-defined format as well as its technical content. If application does not have any missing information the second step, assignment of external evaluators, follows the first one.

TÜBİTAK uses external evaluators in order to check technological, managerial and economic aspects of the projects within a given set of criteria. Experts are selected among academicians having at least PhD degree and working for universities or research institutions. At the second step of pre-screening of project assessment, TÜBİTAK selects two or more external evaluators depending on the budget and the complexity of the project. Then, external evaluators are asked to visit firm and have face-to-face meeting with project team to understand the project proposal.

During the assessment or project proposals, three-dimensional evaluation model is used by TÜBİTAK. The rationale behind implementation of three-dimensional evaluation model is explained in the article entitled as “Three Dimensional Evaluation Model for R&D Proposals in Turkey”. (Cebeci et al.,

2006) The article points out that industrial research can be evaluated with the following criteria:

- technological level of the research
- innovativeness of end product or outcome,
- feasibility of the R&D process

Assessment of project proposals is strictly correlated by the framework described above and it is performed by the following three main criteria:

- Industrial R&D content of the project, its innovation potential and technological merit
- Relevance of project plan with planned activities and the technical and managerial capability of the firm
- Economic potential of final outcome, and its contribution to national economy

TÜBİTAK provides an assessment template for external evaluators, coded as AGY200[14] which organized around three main sections outlined above.

After getting assessment reports from all evaluators, only one step remains for final funding decision. When all assessment reports are collected, TÜBİTAK expert consolidates them and prepares a summary report and submit his/her report to the related evaluation committee. Evaluation committees are formed by TÜBİTAK and they consist of five academicians who are appointed for three years as committee member. There are five technology group committees and these are:

- Information technologies
- Biotechnology, agriculture, food and environmental technologies
- Electric and electronic technologies
- Machinery and manufacturing technologies
- Material, metallurgy and chemistry technologies

Committee evaluates project proposals in accordance with three-dimensional evaluation model which is presented above and final funding decision is formed within the committee with respect to the content of project proposal, assessment reports of external evaluators and TÜBİTAK

[14] AGY200 can be accessible from the following web address: www.tubitak.gov.tr/tubitak_content_files/TEYDEB/1501/basvuru/AGY200-02.doc

experts' opinions. If decision is positive, funding contract is signed between TÜBİTAK and firm and the process continues as it is explained in the next section.

5.1.2. Project Funding and Monitoring

TÜBİTAK obliges firms to report the progress in its project twice a year. First reporting period covers between January and June and the second one covers between July and December. Firms have to submit progress reports for each six months period and they have to submit their report within three months after the last month of each period not to lose their right to claim funding from TÜBİTAK.

Therefore, firms are asked to provide two separate reports in each six months period reflecting technical progress and financial figures. AGY300[15] document has to be prepared for reporting technical achievements and a financial report[16] (which does not have a specific code) has to be prepared to show expenses related to reported achievements respectively. In order to confirm existence and accuracy of expenses firm have to get approval from a chartered accountant for their financial report.

When firm sends progress reports to TÜBİTAK, one copy of report is sent to selected external evaluator who was previously appointed for the assessment of the proposal, to see the progress in the project. It is asked to evaluator to have on-site visit and asses the progress on behalf of TÜBİTAK. Afterwards evaluator prepares a report coded as AGY400[17]. Simultaneously technical progress report and financial report are examined by TÜBİTAK in order to check relevance of the achievements and expenses with the proposed ones.

If nothing is negative in financial examination stage and if evaluator's comments are positive on the progress, TÜBİTAK calculated the amount of funding to be transferred to the firm and inform UFT for payments to be

[15] AGY300 can be accessible from the following web address:
www.tubitak.gov.tr/tubitak_content_files/TEYDEB/1501/destek/AGY300-02.doc

[16] Financial Report can be accessible from the following web address:
www.tubitak.gov.tr/tubitak_content_files/TEYDEB/1501/destek/Mali_Rapor.doc

[17] AGY400 can be accessible from the following web address:
www.tubitak.gov.tr/tubitak_content_files/TEYDEB/1501/destek/AGY400-02.doc

done. As indicated earlier in the document, 75% of the grant is paid from TÜBİTAK's budget and the remaining 25% is covered by UFT.

This process is repeated in every six months until the completion date of the project. In the last reporting period firm have to submit project final report coded as AGY350[18]. In order to get final payment, it is obligatory for firm to submit final report with the latest progress report. Therefore there is a final report in every completed project.

Since AGY350 is submitted at the end of the project and it reflects the experience of the firm gained throughout the project as well as achievements of the project, AGY350 is a good source which can be utilized for an evaluation study.

5.2. Design of Evaluation

Georghiou and Roessner (2000:657) claims that

> Demand for evaluation has been fueled by the desire to understand the effects of technology policies and programs to learn from past and, more instrumentally, to justify continuation of those policies to a sometimes skeptical audience.

In his sentence, Georghiou and Roessner roughly summarize the rationale behind for conducting an evaluation study which is broadly discussed in Chapter 2.

It is apparent that evaluation is needed to unveil additionality generated by the programme which is simply needed for the assessment of additional value generated by public money. In addition, it is also beneficial to pinpoint problems or merits of the programme which provide inputs for improvement of the existing programme or development of a new one. Moreover, evaluation provides inputs for new policy design; it can be used for a communication instrument to help programme managers and policy makers for promoting the success of the programme.

These arguments are also valid for Turkish case and it is an emerging need for evaluation of TÜBİTAK's Industrial R&D Projects Funding Programme. Figure 9 also demonstrates the need of having a programme-wide evaluation study

[18] AGY350 can be accessible from the following web address: www.tubitak.gov.tr/tubitak_content_files/TEYDEB/1501/destek/AGY350-02.doc

based on TÜBİTAK programme because total amount of funding channeled to Turkish industry exceeds 400 Million USD in 12 years.

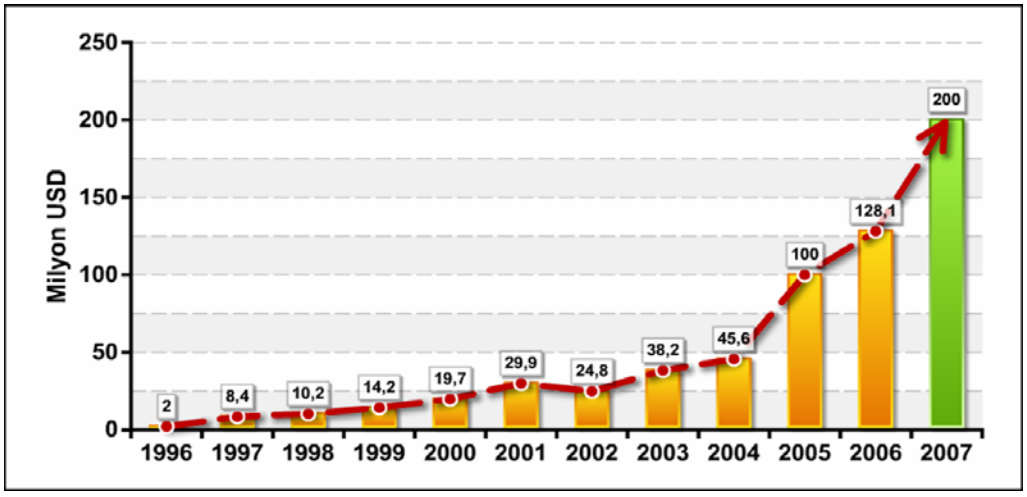


Figure 9 – Industrial R&D funding, 1996-2007 (Source: TÜBİTAK Data)

Also, 15th SCST drew an attention to the need of conducting an evaluation study and 2007 was addressed as a beginning of evaluation activities. However, there has not been any formal announcement on the forthcoming evaluation study within TÜBİTAK. There is only a pilot scale study published as M.S. thesis by Abdullah Gök on measurement of behavioral additionality effect of TÜBİTAK (Gök, 2006). The thesis published in 2006 and entitled as "The Concept of Behavioral Additionality of Public Support for Private R&D and A Methodological Proposal for An Evaluation Framework in Turkey" analyses the programme in term of its additionality effect and proposes a methodology for firms to measure behavioral additionality effect of the programme.

Even though Gök's (2006) work on behavioral additionality aspect of the programme adopted an accurate methodology and come up with set of suggestions to improve evaluation system in the future, it only focuses on behavioral additionality effects and neglects other additionality types as well as implications of the analysis on programme management and future policy recommendations.

The main aim of this thesis is to reveal input, output and behavioral additionality effect of the programme. The expected result of the study is to derive some preliminary results on the impact of the programme on Turkish industry but more importantly this thesis will act as a precursor of a large

scale evaluation practice addressed in the 15th meeting of SCST and tests the relevance of evaluation studies in TÜBİTAK case.

Since this study is proposed a as precursor of the real evaluation practice of TÜBİTAK's industrial R&D funds, it should be a pilot scale study which is large enough to give meaningful results for further analysis. Therefore, research design is the core issue of the thesis on which evaluation methodologies and data collection activities will build in order to get accurate results at the end. The next three sub-sections will explain research steps in detail staring from research design, it will continue with presentation of selected evaluation methods and data collection efforts will be discussed at the end.

5.2.1. Research Questions

Recent evaluation practices of OECD countries demonstrates that additionality of government funding is the main concern and analysis of national and international funding mechanisms are centered around this concept as it was addressed by various researchers, such as Almus et al (2001), Ebersberger (2005), Falk (2005), Georghiou (2004), Georghiou et al. (2000, 2006) and Ruegg et al. (2003). Thus, this pilot study will follow the framework introduced by these pioneers on this field and concentrate on the additionality of the TÜBİTAK funding. Hence answer for the following questions guide the research in this respect.

What is the effect of TÜBİTAK's funding on R&D expenditure of funded firms? The correlation between R&D expenditures of the firm and the amount of public funding is analyzed here. In order to find an answer to this question, annual R&D expenditures of firms and total amount of funding provided to the firms are the main indicators which will be used for analysis.

What is the effect of TÜBİTAK funding on commercialization of the product and process developed in the project? This question addresses output additionality effect of the TÜBİTAK funding. Although it is difficult to measure the commercial potential of the project, firm's declaration about the changes in turnovers attributable to the product or process in question, firm's estimation for the increase its share on the market can be regarded as the indicators of existence of output additionality.

What are the consequences of TÜBİTAK funding in terms of behavioral changes such as change in the absorptive capacity of the firm, changes in the organizational structure, its impact on collaboration with other parties?. Especially behavioral additionality refers to strategic changes within the firm which is difficult to measure, yet it is regarded as the most durable impact of funding (Rye, 2002). However, "strategic change" is a broad term and it needs to be specifically elaborated. Therefore, behavioral additionality effect of the programme is examined into more specific sub-branches as outlined in Section 2.4.3. Especially scale, acceleration, scope and cognitive capacity additionality are scrutinized to find behavioral changes in firms.

In addition to these questions on additionality of the funding, there should be analysis of the functionality of the programme. In other words, firms should be asked to evaluate whether the programme has encouraged them or not: "Why did you applied for TÜBİTAK funding? What is the positive and negative aspect of the programme?"

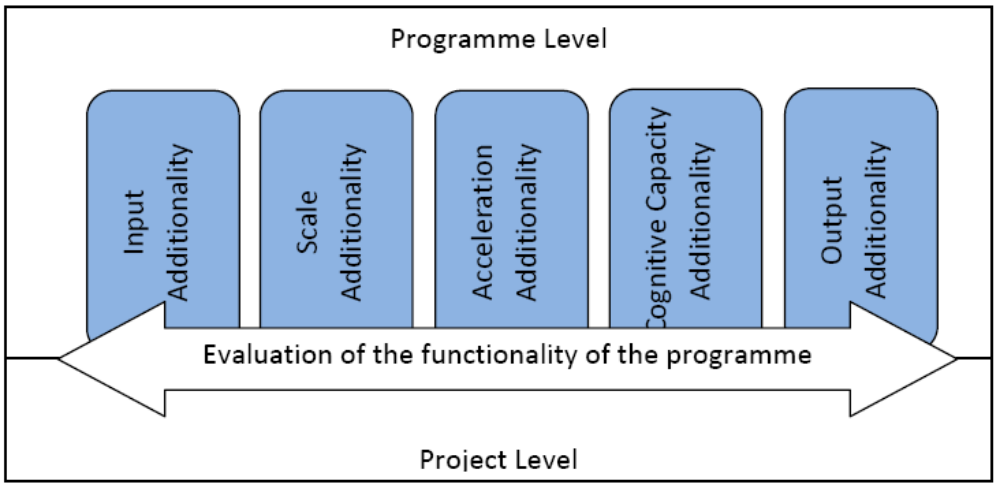


Figure 10 – Relation between research questions

Figure 10 shows the relationship between research questions and groups them under two main layers. First layer includes project based analysis gathering results of the additionality aspect; the second layer refers to the evaluation of the programme and reflects feedback gathered from firms on programme management.

5.2.2. Selected Methodology

RTD Toolbox (Fahrenkrog et al, 2002) lists convenient evaluation methodologies such as innovation surveys, econometric models, control group approaches and field/case studies which are also summarized in Section 2.3. RTD Toolbox (Fahrenkrog et al, 2002) mentions various methods to capture the desired outcome of the programme with respect to available data in order to evaluate different aspects of the programme but at the same time it states that each evaluation methodology is not the rival of the others on the other hand, each one complements others.

When methodologies listed in Section 2.3 are considered, the most suitable option for data collection is innovation surveys because it provides comprehensive data for evaluators and allows them to derive descriptive statistics from it. Therefore, innovation survey is accepted as main methodology in this pilot evaluation study. However, innovation survey is not enough alone and control group approach which is mentioned in RTD Toolbox as a complimentary methodology to innovation surveys are selected for analysis.

Control group approach requires stratification of target population into different groups having unique characteristic. RTD Toolbox (Fahrenkrog et al., 2002) proposes categorization of three groups while conducting evaluation studies. First group contains real beneficiaries of the programme which means that firms applied and received public funding. The second group consists of firms who applied for funding but failed to receive support for their projects. Third group is composed of firms who have not applied funding instrument in question. The logic behind such stratification is to observe difference generated by funding instrument by comparing target group, first one, with the others.

Simplified, reduced version of control group approach is also selected as complementary methodology for this study. As it was mentioned in sub-section entitled as “Selection of Sample”, construction of a uniform sample is very easy from TÜBİTAK data. However, the real challenge is to form samples described in second and third group.

Formation of a group composed of firms whose project applications were previously rejected by TÜBİTAK is relatively easy compared to the effort needed to gather a set of companies which have the same characteristics

with the first and the second group. Due to the fact that formation of a third group requires close cooperation with the other parties providing access to national firm database, adding a group of companies who have not applied to TÜBİTAK, is not included in this analysis.

In other words, this thesis will compare funded and non-funded firms from Ankara operated on computer science and technology domain. Thus, meaningful data set large enough for a pilot study has to be constructed. Next section is first devoted to explanation of selection of sample and then data collection activities will be discussed afterwards.

5.2.3. Selection of Sample

In order to conduct a pilot evaluation study within the framework with selected evaluation methodology, a sample has to be constructed to implement selected methodology. As it is shown in Figure 11, the programme has received 5184 project applications, 2113 of which have already completed. Conducting a detailed analysis on a huge sample is too costly for a thesis study in terms of time and financial resources. Therefore, first step in this study is to extract more uniform and manageable sample which will provide meaningful result at the end. On this account, data is subject to categorization in terms of technological/sectoral and regional distribution.

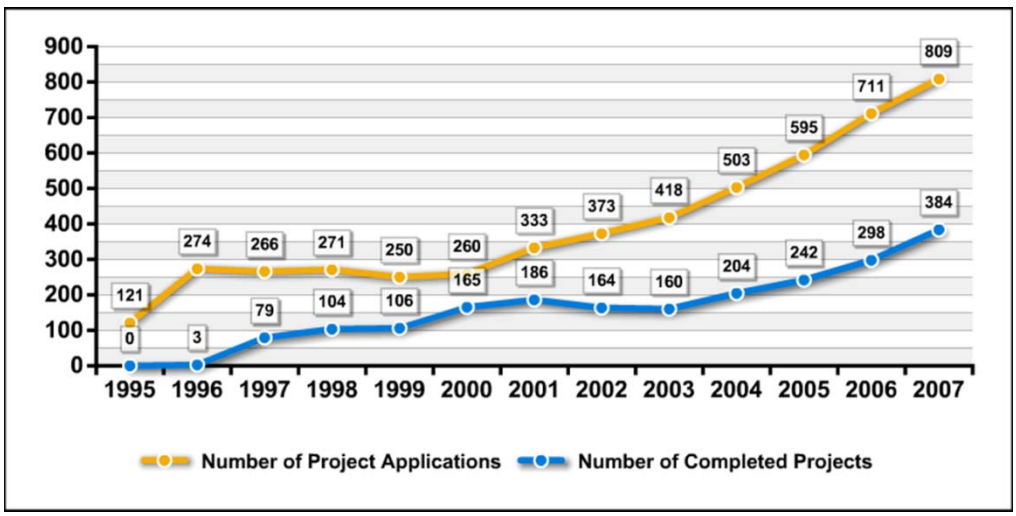


Figure 11 – Number of project applications and completed projects in years (Source: TÜBİTAK Data)

As it was mentioned during the introduction of the application procedures of the programme, companies are asked to write down related technology

codes in AGY100 form indicating main technological domain of the project. TÜBİTAK uses a unique technology classification[19] system which categorizes more than 800 different technologies under 31 main groups. Abridged version of technology codes including main technology groups used in this study can be found in Appendix B.

When project applications are sorted according to technology areas, top five technologies in terms of project application and completed projects are as follows:

Table 3 – Top 5 technology areas in terms of project applications and completed projects (Source: TÜBİTAK Data)

Technology Areas	Project Applications (%)	Completed Projects (%)
Mechanical Engineering & Technology	30,05	30,29
Computer Sciences & Technology	15,12	14,10
Electric-Electronic Engineering & Technology	10,07	8,71
Material & Metallurgical Technology	9,39	11,03
Chemical Engineering & Technology	8,56	9,23

Table 3 shows that mechanical engineering and technologies occupies the first place while computer science and technologies are in the second place in terms of project applications and completed projects. Mechanical engineering technology approximately constitutes 30% of whole project portfolio, and respectively computer science and technology has a share around 15%. Therefore, at least one of these two technologies can provide sufficient sample for a sectoral evaluation study[20].

Similarly, regional distribution of the projects allows us to see potential of cities which may indicate regional bias in project applications as well as completed projects. Appendix D lists number of project applications and completed projects coming from each city and Table 5 lists top 5 cities which looks very interesting in a sense that cities listed here captures almost 80% of the whole project portfolio and top two cities, İstanbul and Ankara include approximately contains 60% of project proposals and

[19] The whole list of technology codes are accesible from the following web address: http://www.tubitak.gov.tr/home.do?ot=5&rt=&sid=481&pid=&cid=3761
[20] Appendix C presents whole list showing all technologies with the same indicators.

completed projects. Therefore, İstanbul and Ankara are the best candidates for pilot evaluation study.

Table 3 and Table 4 refer to the same conclusion that projects are not uniformly distributed over all technological areas which raises the need to focus on a selected technology and/or city for analysis. Since TÜBİTAK's programme is a generic one and is open for all cities and does not have any regional discrimination, it is rich in regional diversity which complicates pilot scale impact analysis. Therefore, sectoral and regional focus is adopted in this study.

Table 4 – Top 5 cities in terms of project applications and completed projects (Source: TÜBİTAK Data)

Cities	Project Applications (%)	Completed Projects (%)
İSTANBUL	31,41	41,17
ANKARA	17,57	18,36
İZMİR	9,29	7,95
KOCAELİ	8,54	8,99
BURSA	6,75	6,44

The advantage of focusing on a specific technological areas is that it allows us to get more uniform results on the additionality of TÜBİTAK support because, additionality may vary from sector to sector depending of the changing nature of R&D. For example, R&D done in traditional manufacturing sectors (e.g. machinery production) has different characteristics from R&D done in emerging technologies (e.g. software industry). Because, new machinery development requires high capital investment such as purchasing of new direct materials, components and the share of labor in R&D process is relatively small compared to other expenses. On the other hand, complex and expensive machinery or extensive direct material is not necessary for software developers, if they have computers they can start coding. Hence R&D personnel are the main component in this sector. Since characteristics of R&D project changes from sector to sector, additionality effect of the programme may change accordingly.

Taking into consideration these facts, it is decided to focus on Ankara because this study is performed in Ankara and it is relatively easy to reach

firms in order to get additional data which is described in Section 5.2.3. Since this pilot evaluation study focuses on the completed projects instead of project applications, distribution of completed projects into technological areas helps us to select the most appropriate technology areas for this study. Appendix E depicts number of completed projects in each technology areas and computer science and technology has the highest share which includes more than a quarter of Ankara projects.

Therefore, target population for this study is 102 completed projects done by 53 different firms. As it can be seen from Table H.7.1 in Appendix H approximately 90% of projects completed after 2002 and for the sake of getting accurate results 13 projects which are completed before 2002 removed from analysis.

Because of the requirements of selected evaluation methodology, a control group is formed among projects previously rejected by TÜBİTAK. There are 47 rejected projects coming from 40 different firms. Table H.7.2 in Appendix shows that all rejected projects in this technology area are rejected between 2002 and 2007 and surprisingly there was no rejected project before 2002.

To sum up, two different samples will be used in this pilot study to seek answers to the research questions explained in Section 5.2.1. Just before starting discussion on the results of the study next section will briefly discuss data collection activities.

5.2.4. Data Collection

Considerable amount of information is collected from companies starting from project application until finalization of the project. Figure 12 shows that five different reports exist in project life cycle. Project application document (AGY100) and (AGY350), can provide valuable information for evaluation study.

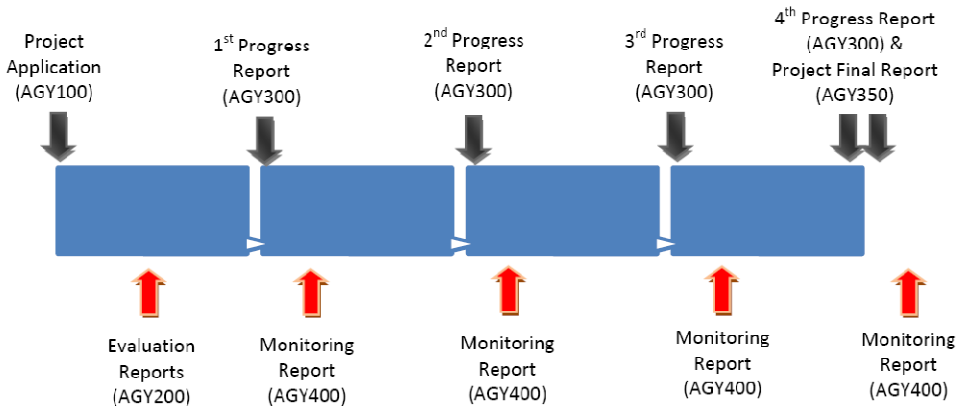


Figure 12 – Reports in project life cycle

The content of AGY100 is summarized in Section 5.1.1 and it only contains planned activities or intentions of the applicant's future R&D works and it is quite far from the actual and performed R&D. Actual work done in the project can be traced from periodical progress reports, but AGY300 is a technical document and it is specifically designed for monitoring purposes.

Therefore, the main data source for the analysis is project final reports (AGY350) which gathers information from companies at the end of the project. Company has to submit AGY350 document to TÜBİTAK in order to get its final payment so that it is a compulsory document. AGY350 has different format than other documents and it asks detailed information in 8 headlines:

- Company information
- Project information
- Project assessment
    - General assessment
    - Assessment of project duration
    - Assessment of costs
    - Assessment of financial aspects
    - Assessment on commercialization potential
    - In-firm effects
    - Out of firm effects
- Assessment of R&D Funding Programme

AGY350 is a very comprehensive document which gathers very rich information on the different aspect of the project including, financial

assessment of the project, outcomes generated, commercialization potential of the end product/process, changes in the knowledge stock and organization of the project and finally comments of the firm on the efficiency of TÜBİTAK support.

Even though AGY350 is a major component of this pilot evaluation study, it fails to cover commercialization aspect of the project because, firms are asked to fill AGY350 document just after the completion of the project. Since TÜBİTAK does not cover commercialization phase of the projects, most of the time firms are still working on the implementation of projects or they have just started to promotion of their products/services when they submit AGY350 document. In a nutshell, AGY350 cannot fully grasp commercial potential of the project which makes design of an additional follow-up questionnaire necessary.

New questionnaire aims to complement AGY350 document in this respect and removes time lag between the completion of the project and the commercialization of it. The questionnaire, can be seen at Appendix F, is composed of three main parts. First part includes contact details of the firm and the respondent. Second part questions overall R&D activity of the firm by asking to fill up a table including annual R&D expenditures, annual turnover and share of R&D exports in annual turnover. There are also separate questions on patent strategy of the firm and recent patent activity and R&D collaboration of the firm.

Third part is focused on the selected project questions the innovation content of the project outcome. Then, market introduction of the outcome is questioned and it is asked firms to provide R&D expenditures and turnover which occurred due to this project. Then the follow-up effect of the project is addressed with respect to the initiation of new R&D projects. Finally, questionnaire ends with a question to identify the reason of failure in commercialization which is only answered by the respondents who failed to introduce their project into the market.

There is a second follow-up questionnaire which is prepared for firms whose projects were rejected. The questionnaire is presented in Appendix G. The reason behind construction of such questionnaire is quite straightforward: After the rejection of the project; TÜBİTAK does not ask

any information to the firms regarding the status of the project. Therefore, having such a questionnaire for data collection purpose is absolutely necessary in order to construct a control group from rejected projects.

Second questionnaire has the same first and second part with the first one which addresses contact details of the firm and respondent and recent R&D activities of the firm. However, third part is longer than first questionnaire and mainly questions the consequences of the rejection. Several questions are directed to the firms asking continuation of the project in the absence of TÜBİTAK funds as well as the duration and the scope of the project.

Consequently, the pilot evaluation study has three major data sources: Project application form, AGY100, is the first source which contains intention of the firms which will be used for benchmarking purposes while comparison of the actual and planned activities. The second data source is, of course, project final report, AGY350 which is the main data source for this study. The third source is additional questionnaires which are presented and discussed above designed to assist project final report in some respect.

5.3. Data Analysis

As outlined in Section 5.2.3, 89 completed projects are selected for analysis h project final reports belonging 70 of them were found in TÜBİTAK archive and analysis performed by taking into consideration of 70 project final reports. Among all projects, 62 of them which accounts for 88%, are done by SMEs, and remaining 8 projects were completed by 6 different large firms. Hence the share of SMEs in the population is 87% in which there are 42 SME in among 47 firms. When number of projects for each firm is considered, 14 of 47 firms have more than one project in this sample and remaining 34 firms represented with only one project.

As explained in previous section, additional follow-up survey is sent to all firms to gather company specific commercial data which will be complimentary to analysis based on AGY350. Surveys are sent to selected firms and only 33 responses were received from selected 70 projects which mean that %47 percent of the projects which will be subject to further analysis.

In addition to the funded projects, non-funded projects are taken into account as a control group for the analysis and specific follow-up questionnaire were sent them. Only 8 responses were received from 35 rejected companies that means response rate to the questionnaire is quite low, accounts for 22% of the sample consisting of rejected project, compared to the completed projects. When firms having rejected projects are considered, 10 of 35 firms have at least one project which is previously funded by TÜBİTAK.

Based on the sample described above, an analysis is conducted with the selected methodologies in order to find answers of research questions. Therefore, next sub-sections will present analytical part of the study in detail.

5.3.1. Input Additionality

The focus on input additionality is to determine

> Whether and to what extend firms increase their privately funded on innovation related activities when supported – i.e. whether the firms itself spends at least one additional Euros on the research project for every Euro received in subsidy. (Falk, 2006:4)

Therefore, correlation between R&D spending and TÜBİTAK funding is needed to show whether the programme has input additionality effect.

In order to measure input additionality effect of the programme the total amount of funding provided to the companies is compared to R&D expenses of the firms for the selected period. If there is a positive correlation between funding and R&D expenses, it is interpreted that government funding has positive input additionality effect.

Since AGY350 does not contain a question to investigate total R&D expenses of the company for the selected period, a special question targeting input additionality is added to follow-up questionnaire. Data showing R&D expenses of the company is matched with TÜBİTAK data on total amount of funding provided to the firm for selected period. Then, correlation coefficient between both data sets is estimated.

Eight companies were selected from sample in which six of them have completed more than one project with TÜBİTAK funding. The remaining two firms have not received any funding from TÜBİTAK although they have applied for funding. The reason behind the selection of these firms is that only these firms provided us accurate data showing their R&D expenses for

the selected period. Therefore, case study approach adopted for this study whose results are shown in Table H.1.1 in appendix and key remarks are summarized below:

Analysis shows that there is a weak correlation between R&D expenses of the firm and TÜBİTAK funding. Among five funded firms only one firm, Firm C exhibits high correlation (0,89) between these two variables which definitely demonstrates the positive input additionality effect of TÜBİTAK funding. When this firm is taken into consideration, it is observed that, the firm has only 11 employees and its all activities depends on only the products developed within two TÜBİTAK funded projects.

Comparison done on the figures of two SMEs, Firm B and Firm C show that a moderate correlation between R&D expenses and TÜBİTAK funding. Firm B has a correlation coefficient of 0,42 and Firm D has 0,47 – exists which indicated that TÜBİTAK funding may positively contribute to the greater R&D expenditure in these companies.

Correlation is less visible in large companies and it can be interpreted that TÜBİTAK funding is less effective on large companies' R&D expenditures. In order to check the validity of the assumption, two companies whose projects were rejected by TÜBİTAK are also added to the analysis. The pattern in R&D expenditures of these companies can provide us the trend in the sector: If funded companies have better performance in terms of the increase in their R&D expenditures compared to the non-funded company, it can be interpreted as the availability of TÜBİTAK funding has positive effect.

In AGY350, firms are asked to list the source of finance from the following options: first option is firms' own sources, the second option is private financial sources acquired by outside of the firm such as bank credits, venture capital, etc., at the third option of government sources which clearly addresses TÜBİTAK funding.

All respondents of AGY350 answered this question by providing financial data and indicate the share of TÜBİTAK funding among the financial sources. This question is directed to determine the funding source of the project, which roughly shows whether firms depend on TÜBİTAK funding during execution of the project or not. It is not possible to estimate input

additionality effect of the programme with the available data derived from AGY350; however, the share of TÜBİTAK funding indicates to what extent firms depend on TÜBİTAK funding for their projects.

When answers to the question on funding sources of the project are scrutinized, most of the answers show that firms complete their project with their own sources as shown in Figure 13. 41 of respondents which accounts for 59% of all sample, indicate that they funded their R&D project with their own sources. 30% of them points out that the share of TÜBİTAK funds lies between 1% and 50% of total budget and finally TÜBİTAK funding contributes more than half of the whole project budget for only 11% of the respondents. Detailed analysis of this section is shown in Table H.1.2 in Appendix H.

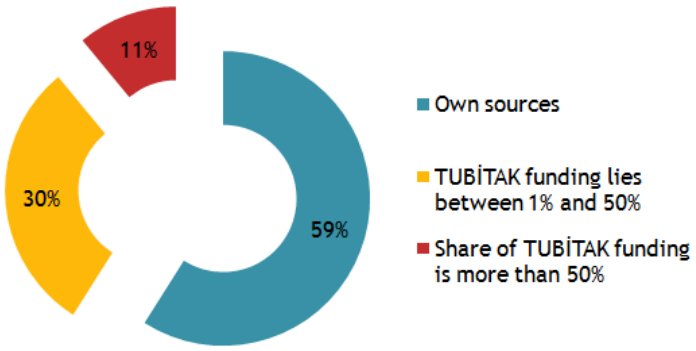


Figure 13 – Funding sources of projects

Additional classification of firms' responses has been done to see the impact of TÜBİTAK funding in terms of firm size as shown in Table H.1.3. Figures indicate that TÜBİTAK funding is more important for SMEs and its effect are more apparent on micro sized firms having less than 10 employees. Conversely, large firms are less dependent to TÜBİTAK funding in their R&D activities because figures in the table show that all firms completed their R&D project with their own resources.

Figures explained up to here, point out that input additionality effect of TÜBİTAK funding is quite weak. Because there is no strong relationship observed between R&D expenses of firms and TÜBİTAK funding. Similarly, analysis done on funding source of projects comes up with the similar

conclusion that more than half of firms funded their project with their own sources.

5.3.2. Scale Additionality

Falk (2006:4) describes scale additionality by saying that "scale additionalities are said to be on hand if public funding allows the project to be conducted on a larger scale". Therefore, the presence of TÜBİTAK funding is expected to cause project to be conducted larger than it is planned.

AGY350 asks firms whether they would continue their project in the absence of TÜBİTAK funding moreover, the question asks scale of the project. Figures showing answers of this question are presented in Table H.2.1 in appendix. Results indicate that 16% of respondents would not continue with the project if TÜBİTAK funding is not available, 37% of them said that they would conduct their project with a smaller scale, 46% of them indicates that nothing would change and project would be conducted in the same scale. The remaining %1 claims that government funding prevented to have a bigger and complex project.

The budget of the project can also be regarded as an indicator of scale additionality because; the extent of TÜBİTAK support may increase or decrease the scale of activities. For example increase in project budget may occur because existence of funding encourages firms to conduct project larger than it was planned. On the other hand, there may be decrease in scale of project because, if TÜBİTAK decided to fund it with a limited scope. In other words, limited funding may discourage firm to do larger project and they scale down planned activities accordingly.

In order to check whether TÜBİTAK has caused a change in the scale of the project, planned and actual budget of the project are compared and the difference in the budget is shown in Table H.2.2 in appendix. Since slight changes can naturally occur in the budget because of uncontrollable factors, like inflation, -+5% deviation from planned budget is regarded as neutral and counted that project finished with the same scale. Therefore, relevant table indicates that almost 60% of the projects completed with smaller budget while only 24% of them do not have experienced any changes in the budget and there are increases in the remaining 16%.

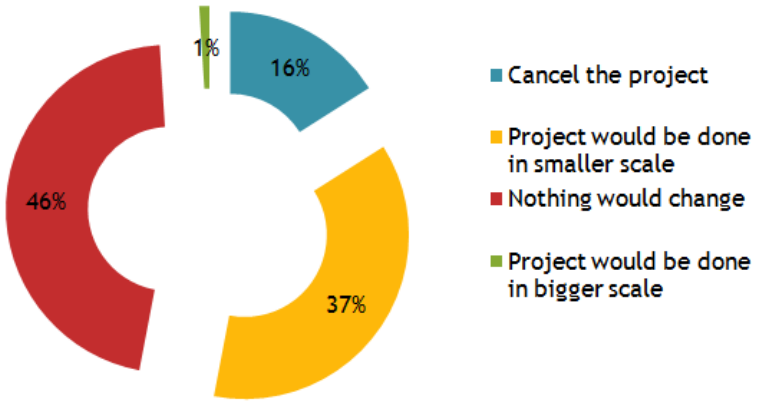


Figure 14 - Status of the project in the absence of TÜBİTAK funding

As depicted in Figure 14, in the absence of TÜBİTAK funding 53% of projects not to be conducted or to be conducted in smaller scale and the existence of funding has positive effect on the scale of projects. However, further analysis is needed to unveil the reason of positive deviation from the planned budget. Therefore, question asking the reasons of deviation from planned budget in AGY350 needs to be tabulated with number of projects having positive, negative or no change in project budget. Table H.2.3 in Appendix H shows that increase in project budget is resulted from change in the objectives and prolongation of project duration. Since these reasons do not explicitly point out increase in the scope of project, existing questions do not help us to attribute increase in project budget to the existence of TÜBİTAK funding.

5.3.3. Acceleration Additionality

Acceleration additionality refers to the impact of funding on the speed of the project. Falk (2006:5) states that

> Acceleration additionalities are said to be in place if participation in innovation schemas speeds up the course of the project. Observable outcomes are, for example an earlier start date of the project, a shorter implementation phase, or a project results are accessible at earlier time.

Even he states that firms prefer to conduct more short-term projects.

In order to test the existence of acceleration additionality the difference between planned and actual project duration is questioned. AGY350 is the excellent source to conduct this analysis because; there is a separate section in AGY350 dedicated to the evaluation of project duration. Two

separate questions exist there: one asks planned and actual start and end date of the project and the second one prompts firm to identify the reasons of the delay. 8 different reasons which listed below are presented for selection:

- Delay in the procurement of equipments, instruments, and etc.
- Change in the targets
- Mistake in the predicted project duration
- Financial difficulties
- Problems of employing high-quality people
- Deficiencies in (R&D) infrastructure
- Delay in R&D service procurements
- Delay in R&D funding

First, change in the project duration is listed and also cross-tabulated with the size of the firm. The result proved that approximately 50% of projects which is independent from firm size are completed on time and only 25% of SMEs and 32% of large companies experienced prolongation between 1 and 6 months. Comparatively, share of firms having prolongation in the project between 6 and 12 months constitutes a small share and there are few firms whose projects last one year or more than planned. Table H.3.1 shows distribution of the projects in terms of prolongation in project duration in detail. Therefore, TÜBİTAK funds encourage half of the firms to finish their projects on time as planned before which implies that TÜBİTAK funding is relatively high acceleration additionality effect.

When prolonged projects are subject to the further analysis, as shown in Table H.3.2, change in the targets of the project is marked by approximately %62 percent of the firms as the main reason. The second reason is mistakes in the prediction of the project duration which is pointed out by 20% of the firms. What is interesting in this analysis is problems in R&D funding and financial difficulties are the weak causes of such delay.

5.3.4. Cognitive Capacity Additionality

Cognitive capacity additionality is very specific type of behavioral additionality which addresses increased learning capabilities of firm as well as increase in networking activities. Cognitive capacity additionality also

overlaps with scope additionality which is also another sub-branch of behavioral additionality measures expansion of the activities of the firm into new markets with the assistance of government assistance. Falk (2006:5) asserts that classification of firms' new competencies related with cooperation in innovation is not important, the important thing is "firm's future innovation behavior is affected in a positive and sustainable way".

AGY350 is again has some to-the-point question which measures in firm and out of firms effects of the programme. "In firm effects" are pointed out by three questions; first question try to reveal whether there is increase in number of personnel, the second one addresses development in R&D related activities and finally the third one questions organizational and management effect of TÜBİTAK funding.

In order to measure employment effect of the programme, change in number of employees should be analyzed. When they apply for funding, firms report number of current employees in project application form. Similarly, firms report number of employees at the end of the project and they also indicate changes in employment resulted from TÜBİTAK funding. Therefore, comparison of two set of employment figures; one of which is derived from project application document and the other is derived from AGY350 reveal employment effect of the programme.

In AGY350, firms are asked to indicate change in the following figures thanks to the TÜBİTAK funding:

- R&D personnel
- Administrative personnel
- Personnel having graduate degree

Among 70 projects, 32 of them which accounts for approximately %47 of the sample, reported that they employed additional personnel because of TÜBİTAK funding. These 32 projects belong to 27 different firms so that employment effect of the TÜBİTAK funding on the firm level is more apparent than project level because, the share of firms reported increase in number of personnel constitutes 57% of the sample.

Although more than half of the firms reported that number of employees increased, a comparative study is needed to see employment effect of the

funding on firm level. Table H.4.1 shows list of firms reported increase in number of personnel. Figures showing total number of employees of the firms change in the number personnel and its breakdown in R&D, production and administration department are listed as well as personnel having graduate degree employed in the firm.

As shown in Table H.4.1, 27 firms having 2114 employees in total recruited additional 238 personnel which accounts for approximately 11% of their total employees. When change in each firm is considered, 12 firms among 27 firms which constitute 44% of firms, report that they expanded more than 25% in terms of number of employees thanks to TÜBİTAK funding.

Positive impact of TÜBİTAK funding in terms of employment effect is quite apparent but what is the share of R&D personnel? Table H.4.1 shows that approximately 58% of new employees are R&D personnel. Moreover, TÜBİTAK funding has also encouraged firms to hire qualified personnel because, 49 of 238 personnel which approximately accounts for 20% of all new employees have graduate degree.

In addition to the increase in the human capital, another factor influencing R&D capacity of the firm is the sign of cognitive capacity additionality. Responses to the question which prompt firms to identify changes in the firm thanks to the TÜBİTAK funding is summarized in Table H.4.2. Approximately 70% of the firms state that TÜBİTAK funding improved R&D infrastructure of the firms, motivated firms to document know-how gained in R&D project, and more importantly it enables firms to gain technology management competency.

In addition to these benefits, firms state that organizational improvement occurred thanks to the TÜBİTAK funding. The most apparent impact on organizational change is increase in training activities as indicated by half of the respondents. Other important consequences of TÜBİTAK funding on organizational change is increasing awareness on the necessity of market analysis in R&D projects and the importance of team culture doing R&D projects as shown in Table H.4.3.

In addition to in-firm effects, there are several questions in AGY350 addressing out-of firm effects of the programme. There are three major questions in AGY350, two of them are the impact of projects on other

sectors and the other one asks whether any collaboration has been achieved in the project. First two questions mainly related to the output additionality effect of the project but, the last question in this sector is simply addresses increase in networking activities with other firms however, question specifically addresses new contacts with other firms which are initiated within the project. When answers to the last question considered, as reflected in Table H.4.4, 80% of projects are resulted with new collaboration with another firm. Figures indicate that %34 of the firms initiated new collaboration with at least 2 and at most 5 firms within the project.

5.3.5. Output Additionality

Output additionality is directly related with the results of project and as Falk (2006:4) states that "it measures the proportion of output that would not have been achieved without public support" Results of the project are either defined as marketable output (i.e. patents or successful innovations) or commercial output (i.e. sales or outputs directly attributable to TÜBİTAK funding).

In TÜBİTAK case, there are only two sources to measure output additionality effect of the programme; first source is AGY350 which contains several questions directed to measure commercial success of the project. There are several questions dealing with qualitative measures such as change in commercial successes however, one question specifically addresses change in market share in national and global market.

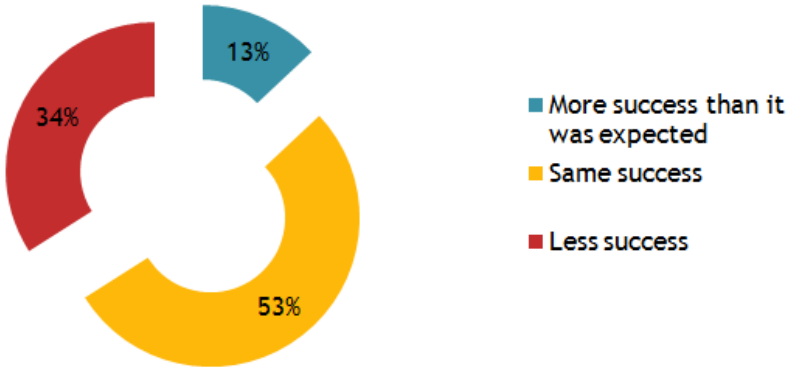


Figure 15 – Commercial success of projects

Table H.5.1 in Appendix H and Figure 15 show that only 13% of projects achieve more success than it was expected. On the other hand, 34% of project achieved less commercial success and %53 of the projects completed with the expected success. When the reasons of commercial failure concerned, firms who previously state that projects experienced less commercial success, identify reasons of failure as indicated in Table H.5.2. 71% of projects state that difficulties in market introduction is one of the primary reasons and the other primary reason is change in economic environment. The other factors, listed in Table H.5.2 are so small that their effects are negligible.

In addition to qualitative measures, firms are prompted to indicate whether sales increased or market share changed thanks to the project. Among 70 projects, 22 of them which accounts for 31%, point out that sales in national market increased. When these 22 projects are subject to further analysis, interesting results appears: 72% of these projects,-16 projects- affirm that their share in national market has also increased.

Although these results show that TÜBİTAK funding has positive impact on firms in terms of generation of commercial success, the relation between TÜBİTAK funding and the commercial success of the project is not apparent. Therefore, more detailed analysis should be done on selected firms to see if there exists a positive relation between these two variables. Follow-up questionnaire has a question targeted to get sales of companies for the period that they benefited from TÜBİTAK funding.

In order to determine output additionality effect of TÜBİTAK funding, the analysis conducted on selected firms to reveal input additionality effect which is explained in Section 5.3.1 repeated with sales data. In other words sales of the selected companies are compared with TÜBİTAK funding. Again, same firms are selected for analysis. 5 of 7 firms are the ones who previously benefitted from TÜBİTAK funding and the remaining 2 firms are listed as a control groups in order to follow change in sales.

Even though methodology used for input analysis is same with output analysis measurement, results are quite different. Among 5 funded firms, only one firm’s data-Firm C- exhibits very strong correlation which accounts for 0.89, between sales and R&D funding as shown in Table H.5.3

in appendix. Correlation between these two variables is quite weak in Firm B, Firm D, Firm E which are 0.41, 0.27 and 0.17 respectively. However, correlation coefficient belongs to Firm A and Firm F is negative which signals that there is negative relationship between TÜBİTAK funding and sales data. Although negative correlation coefficient does not mean that existence of TÜBİTAK funding does not create additional commercial return, it only shows that change in sales is not directly affected by TÜBİTAK funding.

When we take into account of trend in sales for funded firms, it can be seen from the Table H.5.3 that change in sales do not follow regular pattern for all firms for selected years. Therefore there is no parallelism between funded and non-funded firms. Since national economy was quite instable from 2000 till 2004, economical instability minimizes the impact of TÜBİTAK funding on the sales data. The most accurate way of measuring output additionality effect of the programme is to study sales generated from funded project instead of overall sales data.

5.3.6. Implications for the Programme

AGY350 is a rich data source which both contains questions targeted to measure the impact of TÜBİTAK funding on project level but there are some questions addressing the efficiency of the programme. Section D of AGY350 is dedicated to programme level issues and three major questions are asked to the firms.

First question targets to reveal reasons of funding applications When answers to the question are considered, as it can be seen from Table H.6.1, the most widespread reason on the application to the programme is additional financial support as indicated by 90% of all respondents. The second and the third answers enforce the idea that TÜBİTAK funding provides prestige to the firm and it is regarded as a quality label.

The second question mainly addresses problems encountered during funding process and it provides several pre-defined problems about the programme. When results are considered, two major problems appear on the top. Approximately 50% of the respondents indicate that delay in the payments is the most important problem and approximately %46 of them draws an attention to the long evaluation and monitoring process. Other

options are relatively minor compared to the first two answers but the interesting aspect is approximately 20% of responses show that no problem is encountered during funding process.

In addition, firms are asked whether they will continue with their project as planned without TÜBİTAK funding as indicated in Table H.2.1 which is also discussed in Section 5.3.2 and presented as the sign of scale additionality. The result presented in this table also shows the overall performance of the programme. According to the figures, only 16% of firms indicate that they will not complete their project in the absence of TÜBİTAK funding.

5.4. Problems Observed in This Study

The main aim of this thesis is to see additionality effect of TÜBİTAK funding with pilot scale study to derive descriptive statistics about the programme and to test selected evaluation methodology in a real case. This evaluation practice is also an actual test environment helping policy makers and evaluators to see possible problems in this process which will provide feedback on future studies.

First problem observed in the study is the difficulty of compiling AGY350 documents from TÜBİTAK archive. Currently, AGY350 documents are received from companies in printed format and they are stored in TÜBİTAK archive after a short review done by TÜBİTAK experts. Since content of AGY350 does not affect monitoring and payment process and they only contain brief information of completed activities, this document are regarded as ordinary one and does not stored electronically. Therefore reaching to needed AGY350 documents and collecting data from them is a very time-consuming activity. In other words, researchers willing to collect data from AGY350 have to deal with tiring search activity among huge collection of folders. For future studies which require comprehensive data collection activity a tiring and time-consuming archive search is needed in order to reach all desired AGY350 reports. Therefore, project data have to be electronically available.

The second problem is associated with formation of control group. As it was discussed in Section 5.2.2, control group approach requires creation of two additional groups of firms in addition to funded firms. Firms whose applications were rejected by TÜBİTAK constitute first control group. It is

relatively easy to construct first control group because TÜBİTAK has contact details of the firms as well as company specific data such as financial details, employment structure, etc. in the its database. However, second group should be formed from firms who have not applied for funding yet which requires to access to national firm database to get list of all firms in Turkey. However, having a list of names is not enough to form second control group because detailed data reflecting financial statements, R&D expenditures, overall sales and revenues generated from innovative products of firms are also needed for evaluation purpose.

Third problem is resulted from small sample size which puts limitation on the generalization of the results to whole programme. Due to the fact that sectoral focus adopted in this programme and only firms from Ankara are selected for further analysis, evaluation results only explains facts and trends in software development sector and results have sector bias. In order to overcome bias, sample size should be extended and other sectors and cities should be represented in sample according to their share in project portfolio. Therefore, large sample size representing all sectors and different cities allow deriving more realistic results for impact of the programme.

Fourth problem comes from the need for gathering additional data from rejected and non-funded firms if control group approach and econometric models are selected for data analysis. In order to perform econometric analysis, panel data of some economic performance indicators and R&D indicators are needed. Having data of firm whose R&D projects supported by TÜBİTAK is relatively easy, on the other hand, TÜBİTAK has limited or no information about rejected firms and non-funded firms. Therefore, the best way to gather information from selected firms is follow-up surveys. On this account, we need to assure that firms have to fill up survey completely and provide requested data. Efforts done in this thesis showed that firms are too reluctant to answer additional surveys. Especially firms whose projects rejected by TÜBİTAK are too ignorant for additional surveys or face-to-face meeting requests. In order to overcome low-response rate to the follow-up surveys a legal commitment is needed to demonstrate the importance of the data collected from companies, and formal voice can ask companies to provide data.

CHAPTER 6

CONCLUSION

Financial support provided to firms to encourage them to undertake more R&D is one of the prominent instruments preferred by governments to increase competitiveness of national economy. Like most of OECD counties, and EU member states, Turkey has been implementing project-based R&D support for firms to promote their R&D activities since 1990s. TÜBİTAK's Industrial R&D Projects Funding Programme which was launched in 1995 and has been operational for more than 13 years; is one of the important R&D funding instrument in Turkey whose impact has not been questioned yet.

Therefore, the need for evaluation of Industrial R&D Projects Funding Programme in terms of its impact on firms is starting point of this thesis. Since recent literature on evaluation of R&D funding instruments is centered on additionality effect of government funding, research questions in this thesis directly targets to reveal additional impact generated by the programme. Pilot scale evaluation study is conducted on firms from Ankara operating on software development sector. 70 projects belonging to 47 firms are selected for this analysis and the impact of the programme is analyzed in terms of input, output and behavioral additionality effect.

Results of the analysis show that the programme has weak input additionality effect which means that there is no parallelism between R&D expenditures of firms and TÜBİTAK funding. SMEs' R&D expenditures are more likely affected by TÜBİTAK funding but it is really hard to detect same parallelism in large firms. Similarly, output additionality effect of the programme is quite weak when yearly sales of firms are compared to TÜBİTAK funding. There is no clear evidence that change in sales does not follow similar pattern with change in TÜBİTAK funding. However, most of the firms subject to the analysis acknowledge that they achieved targeted or more commercial success by means of TÜBİTAK funding.

Although it is hard to say that input and output additionality effect of TÜBİAK funding is visible in firm level with existing data, this study shows more definite results for behavioral additionality. Existence of TÜBİTAK funding encourages firms to do their projects in bigger scale and to complete them on time. More importantly, TÜBİTAK funding has very positive effects on job creation and contribution of the employment of R&D personnel. In addition, TÜBİTAK encouraged firms to invest more in training activities, to gain technological management capacity and to improve their R&D infrastructure. In other words, it helps firms to increase their technical and managerial capacity.

Given these results summarized above, it can be concluded that TÜBİTAK funding triggers positive behavioral changes in firms however, it is not possible to say that funding enables firms to invest more in R&D and to get higher commercial success at the end of their projects. On the other hand, the overall consequences of this study cannot be solely reduced to results of data analysis. This study has also some implications regarding to the way of evaluation study conducted, the selection of sample, and suggestion for further research on this field.

First implication of this study is related to selection of evaluation methodology. When results of evaluation study considered, behavioral effects are apparently more visible than economic effects because they are mostly based on qualitative measures derived from personal views of firm representatives. Because, analysis directed to measure input and output additionality compares R&D expenditures and sales with funding provided to firms and based on quantitative data. Therefore, data derived from limited questionnaires fail to grasp all dimensions of economic potential of R&D projects and the extent of R&D expenditures. Econometric analysis should be applied to selected sample population which covers long-term economic data including TÜBİTAK; funding, firm performance, fluctuations in economic environment in order to derive accurate results on input and output additionality effect of the programme.

The data collection process and data collection tools are other important aspects. Two main data source are used in this study: First data source is TÜBİTAK archive where only limited amount of data are stored electronically and most of documents including AGY350 documents are stored as printed material. The second data source is additional follow-up questionnaire. Since follow-up questionnaire is kept very simple to encourage firms to respond questionnaire without having too much difficulty its content become very limited. Therefore,

further studies should balance simplicity with data needs and prepare better follow-up questionnaire. Similarly, TÜBİTAK data should be accessible electronically to get panel data covering years between 1995 and 2008 in order to create comprehensive database.

Implications for methodology is not only limited to data collection activities but also includes suggestions for the formation of control groups. In order to perceive difference generated by the programme, firms that benefitted from the programme should be compared with non-funded firms and therefore construction of a sample among non-funded firms has critical importance. However, firms from non-funded group should be accurately matched with funded firms to make a realistic comparison. Evaluation literature includes various studies explaining how to mach these firms and especially propensity score method as suggested by Rosenbaum and Rubin (1983) provides a framework for evaluators.

Second implication is related with the size and composition of sample. Restricting sample to a specific sector and specific city allows elimination of sectoral and regional diversity and to get more unified sample which enables fast data collection for a thesis study. However, such limitation prevents generalization of results to the programme level. Since sample in this thesis constitutes relatively small portion of whole population, larger sample should be selected for programme level analysis.

Third important implication is the necessity of political commitment to future evaluation studies. Since this thesis reflect personal effort of the author, additional data collection requests (i.e. follow-up surveys) have no binding effect on firms selected for sample which is the main reason of low response rate. Therefore, programme level evaluation study has to be supported with TÜBİTAK management and data collection has to be done in a professional way to guarantee sufficient data. In addition, further studies may enforce evaluator to work with other institutions such as Turkish Statistics Institute, Ministry of Finance, Ministry of Industry and Commerce, Turkish Technology Development Foundation, to get additional data, official support and formal voice can be needed to facilitate cooperation between evaluators and these institutions.

Another implication is related to the framework conditions and economic factors. The analysis conducted in this thesis takes projects and firms as isolated from macroeconomic conditions (i.e. inflation effects, economic environment) and

acquisitions, changes of ownership and etc. which may drastically influence economic performance. Since Turkey experiences severe economic crises in 1990s, effect of them should be included in future studies.

Even though this thesis has some limitations summarized above, it presents rough measures of additionality effect of TÜBİTAK's Industrial R&D Projects Funding Programme and it tests proposed evaluation methodologies on TÜBİTAK data which provides feedback to future evaluation practices. Therefore, this thesis will be successful if it inspires further evaluation studies.

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APPENDICES

Appendix A – Overview of Technology Development and Innovation Supports of KOSGEB

Name of Support	Upper Limit (YTL)[21]	Support Ratio	Support Type	Remarks
Support for acquisition of equipments, materials and raw materials for pilot run and prototype production	200,000	80%	Loan	Support will be provided with assurance and company pays back support within 24 months after finishing the project
	50,000	50%	Grant	If related equipment acquired by leasing, leasing cost will be provided
Support for improvement of quality (in products) and purchasing of technological equipment	50,000	80%	Loan	Support will be provided with assurance and company pays back support within 12 months after finishing the project
	15,000	50%	Grant	If related equipment acquired by leasing, leasing cost will be provided
Consultancy Support	20,000	80%	Grant	
Dissemination of R&D results	20,000	80	Grant	Expenses related to publication of books and booklets, or preparation of electronic media such as CDs, are eligible in the purpose of dissemination
	3,000	80	Grant	
Support for office rents (for firms located in science parks)	20,000	80%	Grant	
Allowance for workshop expenses				
Support for participation of international conferences, fairs, symposiums, meetings, etc.		80%	Grant	

[21] YTL Stands for New Turkish Lira

Appendix B – Technology Codes

Technology	Explanation
120000-129999	Mathematics
210000-219999	Astronomy and Astrophysics
220000-229999	Physics
230000-239999	Chemistry
240000-249999	Life Sciences
310000-319999	Agricultural Sciences (Farming, Water products, Veterinary,
320000-329999	Health Sciences
330000	Engineering Technology (Generic)
331100-331199	Aerospace Engineering & Technology
331200-331299	Chemical Engineering & Technology
331300-331399	Civil Engineering & Technology
331400-331499	Computer Sciences & Technology
331500-331599	Control Engineering & Technology
331600-331699	Electric-Electronic Engineering & Technology
331700-331799	Environmental Engineering & Technology
331800-331899	Food Sciences & Technology
331900-331999	Geological Sciences
332000-332099	Industrial Engineering & Operational Research
332100-332199	Information Systems & Communication Technologies
332200-332299	Instrumentation & Measurement Technology
332300-332399	Material & Metallurgical Technology
332400-332499	Mechanical Engineering & Technology
332500-332599	Mining Engineering & Technology
332600-332699	Petroleum & Natural Gas Engineering
332700-332799	Textile Engineering & Technology
339999	Others (Engineering)
400000-600000	Social Sciences
621200-621299	Buildings and Construction Materials
621600-621699	Industrial Design
629999	Others
700000	Art

Appendix C - Distribution of Project Applications and Completed Projects into Technology Areas

Technology Areas	Number of Project Applications	Number of Completed Projects
Mathematics	2	0
Astronomy and Astrophysics	0	0
Physics	8	2
Chemistry	59	24
Life Sciences	94	34
Agricultural Sciences (Farming, Water products, Veterinary, Forestry)	75	18
Health Sciences	53	13
Engineering Technology (Generic)	37	2
Aerospace Engineering & Technology	57	25
Chemical Engineering & Technology	444	195
Civil Engineering & Technology	35	8
Computer Sciences & Technology	802	298
Control Engineering & Technology	72	33
Electric-Electronic Engineering & Technology	536	184
Environmental Engineering & Technology	48	9
Food Sciences & Technology	148	46
Geological Sciences	1	0
Industrial Engineering & Operational Research	96	31
Information Systems & Communication Technologies	296	189
Instrumentation & Measurement Technology	153	95
Material & Metallurgical Technology	489	233
Mechanical Engineering & Technology	1560	640
Mining Engineering & Technology	19	5
Petroleum & Natural Gas Engineering	3	1
Textile Engineering & Technology	81	24
Others (Engineering)	1	0
Social Sciences	3	0
Buildings and Construction Materials	4	1
Industrial Design	7	1
Others	3	2
Art	0	0

Appendix D – Distribution of Project Applications and Completed Projects into Cities

City	Project Applications	Completed Projects
ADANA	82	26
AMASYA	2	0
ANKARA	911	388
ANTALYA	18	3
AYDIN	15	3
BALIKESİR	4	0
BARTIN	1	0
BİLECİK	9	0
BİTLİS	1	0
BOLU	15	8
BURDUR	1	1
BURSA	350	136
ÇANAKKALE	44	13
ÇANKIRI	2	1
ÇORUM	3	2
DENİZLİ	35	16
DİYARBAKIR	2	1
DÜZCE	7	0
EDİRNE	1	1
ELAZIĞ	1	0
ESKİŞEHİR	32	13
GAZİANTEP	67	25
HATAY	11	4
ISPARTA	5	0
İSTANBUL	1992	870
İZMİR	482	168
K.MARAŞ	7	3
KARABÜK	2	1
KARAMAN	2	0
KASTAMONU	2	0
KAYSERİ	55	14
KIRIKKALE	16	10
KIRKLARELİ	35	21
KIRŞEHİR	1	0
KİLİS	1	0
KOCAELİ	443	190
KONYA	84	22
KÜTAHYA	22	10
MALATYA	2	0
MANİSA	218	90
MARDİN	1	0

MERSİN	47	26
MUĞLA	7	0
SAKARYA	65	19
SAMSUN	4	0
SİNOP	2	1
SİVAS	3	1
ŞANLIURFA	1	1
TEKİRDAĞ	44	15
TOKAT	1	0
TRABZON	7	3
UŞAK	4	0
YALOVA	6	1
YOZGAT	1	1
ZONGULDAK	10	5

Appendix E – Distribution of Completed Projects Coming from Ankara in Technology Areas

Technological Areas	Number of Projects	Share
Computer Sciences & Technology	102	26,29%
Mechanical Engineering & Technology	56	14,43%
Instrumentation & Measurement Technology	51	13,14%
Electric-Electronic Engineering & Technology	39	10,05%
Information Systems & Communication Technologies	35	9,02%
Material & Metallurgical Technology	24	6,19%
Aerospace Engineering & Technology	22	5,67%
Chemical Engineering & Technology	20	5,15%
Life Sciences	15	3,87%
Agricultural Sciences (Farming, Water products, Veterinary, Forestry)	5	1,29%
Control Engineering & Technology	5	1,29%
Civil Engineering & Technology	3	0,77%
Health Sciences	2	0,52%
Food Sciences & Technology	2	0,52%
Industrial Engineering & Operational Research	2	0,52%
Textile Engineering & Technology	2	0,52%
Chemistry	1	0,26%
Mining Engineering & Technology	1	0,26%
Petroleum & Natural Gas Engineering	1	0,26%

Appendix F – Follow-up Questionnaire Sent to Funded Firms

1. Contact details of firm

Project No	
Name of The Firm	
Address	
Date of Establishment	
Questions related to the respondent	
Name and Surname	
Title	
E-mail Address	
Other Contact Information	

2. Information related to the performance and activities of the firm

2.1. Please fill in the following table with yearly R&D expenditure and yearly turnover of your company and the share of exports to yearly turnover. Please provide these figures from the year which you submit your project to TÜBİTAK and write them down for the following five years.

Years	200.	200.	200.	200.	200.
R&D expenditures					
Yearly Turnover					
Share of exports in yearly turnover					

2.2. Did your R&D project result in a product or process subject to any patenting activity? If so, how many patents does your company have?

2.3. Does your firm work with another partner in one of your R&D projects? If so, please indicate top three partners that you have strongest relationship with.

	Name of the Partner	Type of relationship (Customer/Supplier/R&D Provider/Beneficiary, Other)	Remarks
1			
2			
3			

3. Information related to the project in question

Please answer the following questions by taking into account of your R&D project which was funded by TÜBİTAK.

3.1. Please state the outcome of the project by selecting one of the options below:

- □ Product innovation
- □ Process innovation
- □ Organizational innovation
- □ Service innovation

3.2. Have you commercialized the product/process developed in your project? If so, please continue with the questions numbered between 3.3 and 3.5 if not; please continue with question numbered 3.6.

3.3. How many year later have you commercialized the outcome of the project after the completion of the project?

- □ Less than one year
- □ Between one and two years
- □ Between two and three years

3.4. Please fill in the following table with yearly R&D expenditures of your project and turnover generated from the outcome of the project. Please provide these figures from the year which you submit your project to TÜBİTAK and write them down for the following five years.

Years	200.	200.	200.	200.	200.	200.
R&D expenditure						
Turnover						

3.5. Has the project triggered the initiation of new project? If so, please write down how many projects was generated for the following programmes?

Type of The Project	Number of Projects
In-house R&D Projects	
R&D projects submitted to TÜBİTAK	
R&D projects submitted to TTGV	

International R&D Projects (FP6, FP7, EUREKA, vs.)	
Others (Please explain)	

3.6. Please state the reason(s) of failure in commercialization of the output of the project:

- □ Poor market analysis
- □ Losing ground of existing technologies
- □ Delay in the completion of the project
- □ Absence of the financial source for commercialization phase

Appendix G - Follow-up Questionnaire Sent to Rejected Firms

1. Contact details of firm

Project No	
Name of The Firm	
Address	
Date of Establishment	
Questions related to the respondent	
Name and Surname	
Title	
E-mail Address	
Other Contact Information	

2. Information related to the performance and activities of the firm

2.1. Please fill in the following table with yearly R&D expenditure and yearly turnover of your company and the share of exports to yearly turnover. Please provide these figures from the year which you submit your project to TÜBİTAK and write them down for the following five years.

Years	200.	200.	200.	200.	200.
R&D expenditures					
Yearly Turnover					
Share of exports in yearly turnover					

2.2. Did your R&D project result in a product or process subject to any patenting activity? If so, how many patents does your company have?

2.3. Does your firm work with another partner in one of your R&D projects? If so, please indicate top three partners that you have strongest relationship with.

	Name of the Partner	Type of relationship (Customer/Supplier/R&D Provider/Beneficiary, Other)	Remarks
1			
2			
3			

3. Information related to the project in question

Please answer the following questions by taking into account of your R&D project which was rejected by TÜBİTAK.

3.1. Have you finished you project? If your answer is no please answer questions numbered 3.2, 3.3 and 3.4 if yes; please answer questions between 3.5-3.10.

3.2. If you had not completed you project, please indicate the reason of it by selecting at least one of the options provided below:

- □ The absence of TÜBİTAK funding
- □ The absence of financial support
- □ The absence of human capital
- □ The absence of technical know-know in the firm
- □ Failure in supply of R&D services

3.3. Have you looked for funding from another funding source for your project?

3.4. Has the rejection of your project negatively affected R&D activities and R&D budget of your firm? If your answer is yes, please indicate the decline in R&D activities and R&D budget of your firm by selecting one of the options provided below:

- □ Less than 25%
- □ Between 25% and 50%
- □ Between 50% and 75%
- □ More than 75%

3.5. Have you finished your project with the same scope as it was in your project proposal?

- □ Yes
- □ No. Only ….% of the project was completed.

3.6. Have you finished you project with same duration as it was stated in project proposal?

- □ Yes
- □ No, It was completed in …. months.

3.7. Please state the outcome of the project by selecting one of the options below:

- □ Product innovation
- □ Process innovation
- □ Organizational innovation
- □ Service innovation

3.8. Have you commercialized the product/process developed in your project? If so, please continue with the questions numbered 3.9 and 3.10 if not; please continue with question numbered 3.12.

3.9. How many year later have you commercialized the outcome of the project after the completion of the project?

- □ Less than one year
- □ Between one and two years
- □ Between two and three years

3.10. Please fill in the following table with yearly R&D expenditures of your project and turnover generated from the outcome of the project. Please provide these figures from the year which you submit your project to TÜBİTAK and write them down for the following five years.

Years	200.	200.	200.	200.	200.	200.
R&D expenditure						
Turnover						

3.11. Has the project triggered the initiation of new project? If so, please write down how many projects was generated for the following programmes?

Type of The Project	Number of Projects
In-house R&D Projects	
R&D projects submitted to TÜBİTAK	
R&D projects submitted to TTGV	
International R&D Projects (FP6, FP7, EUREKA, vs.)	
Others (Please explain)	

3.12. Please state the reason(s) of failure in commercialization of the output of the project:

- □ Poor market analysis
- □ Losing ground of existing technologies
- □ Delay in the completion of the project
- □ Absence of the financial source for commercialization phase

Appendix H – Data Tables

Table H.1.1 – Comparison between R&D Expenses and R&D Funding for Selected Firms

	# of Employees		2000	2001	2002	2003	2004	2005	2006	2007	Correlation Coefficient
Firm A	262	R&D Expenses*	176,48	479,02	232,45	1177,61	745,53	1585,22	1115,09	1612,1	0,26
		R&D Funding	19,72	54,13	477,85	948,25	794,98	392,76	246,99	290,65	
		% Increase		171%	-51%	407%	-37%	113%	-30%	45%	
Firm B	6	R&D Expenses*		1,73	2,6	3,79	6,76				0,42
		R&D Funding		19,58	24,3	39,92	28,68				
		% Increase			50%	46%	78%				
Firm C	11	R&D Expenses*				128,69	351,03	335,16	527,6		0,89
		R&D Funding				41,61	112,19	137,67	140,07		
		% Increase					173%	-5%	57%		
Firm D	113	R&D Expenses*				247,95	358,09	136,5	333,89		0,47
		R&D Funding				287,46	593,62	299,97	241,4		
		% Increase					44%	-62%	145%		
Firm E	36	R&D Expenses*			54,88	280,00	280,00	267,10	244,00	256,00	0,37
		R&D Funding			27,15	87,56	15,90				
		% Increase				410%	0%	-5%	-9%	5%	
Firm F	33	R&D Expenses*					79,46	422,66	715,62	1.201,95	0,49
		R&D Funding			7,68	124,98	8,4	121,98			

		% Increase						432%	69%	68%	
Firm G.	13	R&D Expenses*		117,85	363,89	403,13	401,43	399,57	377,45		
		R&D Funding									
		% Increase			209%	11%	0%	0%	-6%		
Firm H	103	R&D Expenses*					132,10	3.678,92	6.956,96	8.544,31	
		R&D Funding									
		% Increase						2685%	89%	23%	

*** Figures showing R&D expenses written in terms of 1000 YTL (New Turkish Lira)**

Table H.1.2 – Share of TÜBİTAK Funding

	0%	1% - 50%	%51 - 100%	Total
Number of respondents	41	21	8	70
% Share	59%	7%	11%	100%

Table H1.3 – Share of TÜBİTAK Funding according to firm size

Number of Employees		0%	1% - 50%	%51 - 100%
< 10	Number of respondents	8	8	2
	% Share	44%	44%	11%
11 - 50	Number of respondents	6	6	3
	% Share	40%	40%	20%
51 – 150	Number of respondents	16	6	3
	% Share	64%	24%	12%
151 - 200	Number of respondents	1	1	0
	% Share	50%	50%	0%
200 - 250	Number of respondents	2	0	0
	% Share	100%	0%	0%
> 250	Number of respondents	8	0	0
	% Share	100%	0%	0%

Table H.2.1 – Change in the scale of the funding

	Yes, with the same scale	Yes, with smaller scale	Yes with a larger scale	No
Number of respondents	32	26	1	11
% Share	46%	37%	1%	16%

Table H.2.2 – Change in the budget of the project

	Decrease in the budget		No Change	Increase in the budget	
	-99% and -51%	-50% and -6%	-5% and +5%	+6% and +50%	+51% and +99%
Number of respondents	**9**	**33**	**17**	**9**	**2**
% Share	**13%**	**47%**	**24%**	**13%**	**3%**

Table H.2.3 – Scale Additionality 4

		Decrease in the budget		No Chage	Increase in the budget	
		-99% and -51%	-50% and -6%	-5% and +5%	+6% and +50%	+51% and +99%
Mistakes in financial planning	**Number of responses**	1	0	0	1	0
	% Share	10%	0%	0%	7%	0%
Prolongation of project duration	**Number of responses**	0	5	2	5	1
	% Share	0%	17%	22%	36%	25%
Changes in the objectives	**Number of responses**	3	10	3	5	2
	% Share	30%	34%	34%	36%	50%
Unexpected expenses occurred	**Number of responses**	0	4	2	3	0
	% Share		14%	22%	21%	0%
Mistakes in prevision of expenditures	**Number of responses**	6	10	2	0	1
	% Share	60%	34%	22%	0%	25%
Total		10	29	9	14	4

Table H.3.1 – Distribution of projects in terms of deviation from planned duration

			Prolongation in the project duration		
		No Change in Project Duration	Between 1 and 6 Months	Between 7 and 12 Months	More than 12 Months
SME	Number of respondents	4	2	1	1
	% Share	50%	25%	13%	13%
Large Firm	Number of respondents	32	20	8	2
	% Share	52%	32%	0%	3%

Table H.3.2 – Reasons of prolongation of projects

Reasons	Number of Responses	% Share
Change in the targets	24	61,54%
Mistake in the predicted project duration	8	20,51%
Financial difficulties	6	15,38%
Problems of employing high-quality people	5	12,82%
Delay in R&D service procurements	5	12,82%
Delay in R&D funding	5	12,82%
Delay in the procurement of equipments, instruments, and etc.	3	7,69%
Deficiencies in (R&D) infrastructure	2	5,13%

Table H.4.1. - Changes in employment figures

			Increase in number of Personnel					
Firms	**Firm Size**	**Number of Employees**	**Production**	**R&D**	**Administrative**	**Having Graduate Degree**	**Total Change (Adm. + Prod. + R&D)**	**% Change in Employment**
Firm 1	Large Firm	269	17	3	1	8	21	8%
Firm 2	SME	6	0	1	0	1	1	17%
Firm 3	SME	38	0	9	0	0	9	24%
Firm 4	SME	17	2	2	0	0	4	24%
Firm 5	Large Firm	491	0	5	0	0	5	1%
Firm 6	SME	97	0	7	0	4	7	7%
Firm 7	SME	75	10	18	0	2	28	37%
Firm 8	SME	199	2	2	1	0	5	3%
Firm 9	SME	33	3	4	1	4	8	24%
Firm 10	SME	14	0	4	0	3	4	29%
Firm 11	SME	16	0	9	0	0	9	56%
Firm 12	SME	5	0	4	0	0	4	80%
Firm 13	SME	249	8	0	0	0	8	3%
Firm 14	SME	3	2	4	3	1	9	300%
Firm 15	SME	82	0	4	0	2	4	5%
Firm 16	SME	13	0	7	0	7	7	54%

Firm 17	SME	15	0	7	2	0	9	60%
Firm 18	SME	32	0	6	0	2	6	19%
Firm 19	SME	76	3	1	0	1	4	5%
Firm 20	SME	11	0	7	0	5	7	64%
Firm 21	SME	49	7	12	21	4	40	82%
Firm 22	SME	9	0	3	0	1	3	33%
Firm 23	SME	48	0	5	6	2	11	23%
Firm 24	SME	13	0	0	1	0	1	8%
Firm 25	SME	5	0	2	0	0	2	40%
Firm 26	SME	8	0	2	0	0	2	25%
Firm 27	Large Firm	241	10	10	0	2	20	8%
Total		2114	64	138	36	49	238	11%

Table H.4.2. - Changes in the firm thanks to the TÜBİTAK funding

	Number of Responses	% Share
Improvement in R&D infrastructure	49	70,00%
Documentation of know-how gained in R&D projects which enables permanence of gained knowledge	49	70,00%
Technology management competency	48	68,57%
Usage of new technology in product or process development	39	55,71%
Positive effect on determination of deficiencies in technological competencies and disabilities	37	52,86%
Improvement in production infrastructure	32	45,71%
Triggered a new R&D project	30	42,86%
Caused decrease in the cost of new R&D projects	25	35,71%
Systematization of acquirement of consultancy services	20	28,57%
Beginning of establishment of R&D infrastructure	18	25,71%
Production costs are decreased	12	17,14%
Revenue gained via sale of patents, know-how and licenses	7	10,00%

Table H.4.3 – Organizational change in the firm thanks to TÜBİTAK funding

	Number of Responses	% Share
Increase in training activities	35	50,00%
Understanding of the necessity of market research for R&D process	34	48,57%
Development of team culture for undertaking of R&D projects	31	44,29%
Increase in participation of conferences, congresses and fairs	31	44,29%
Supporting of R&D activities (new idea generation) within the firm as well as increseing participation to them	29	41,43%
Dissemination of R&D consciousness including among the top management	27	38,57%
Adoption of project based R&D approach	21	30,00%
Increase in internet usage	20	28,57%
Creation of dedicated R&D budget	19	27,14%
Restructuring of existing R&D department	17	24,29%
Implementation of new management techniques	14	20,00%
Establishment of R&D department	10	14,29%

Table H.4.4 – Networking effect of the programme

	Yes				No
	1 Firm	Between 2 and 5 Firm	Between 6 and 10 Firm	More than 10 Firm	
Number of Responses	12	24	10	10	14
% Share	17%	34%	14%	14%	20%

Table H.5.1. – Change in commercial success of project when compared to planned activities

	Commercial Success		
	Higher	Lower	Same
Number of responses	9	24	37
% Share	13%	34%	53%

Table H.5.2. – Reasons of change in commercial success

	Number of Responses	% Share
Difficulties in market introduction of projects	17	71%
Change in economic environment	15	63%
Lack of enough financial support for commercialization	7	29%
Faster market introduction of rival products	3	13%
Technical failure of the project	1	4%
Lack of foresight study	0	0%

Table H.5.3. –Comparison of Sales with R&D Funding for Selected Firms

	# of Employees		2000	2001	2002	2003	2004	2005	2006	2007	Correlation Coefficient
Firm A	242	Sales	1692,08	4428,25	2682,9	3442,25	5827,89	12373,19	28638,18	35223,49	-0,21
		R&D Funding	19,72	54,13	477,85	948,25	794,98	392,76	246,99	290,65	
		% Increase		162%	-39%	28%	69%	112%	131%	23%	
Firm B	6	Sales		48,09	76,19	95,37	160,66				0,41
		R&D Funding		19,58	24,3	39,92	28,68				
		% Increase			58%	25%	68%				
Firm C	11	Sales				325,48	591,08	1376	1777,09		0,85
		R&D Funding				41,61	112,19	137,67	140,07		
		% Increase					82%	133%	29%		
Firm D	113	Sales				4714,48	6697,08	7902,41	5768,36		0,27
		R&D Funding				287,46	593,62	299,97	241,4		
		% Increase					42%	18%	-27%		
Firm E	36	Sales			1469,42	2853,45	3224,77	3340,59			0,17
		R&D Funding			27,15	87,56	15,90				
		% Increase				94%	13%	4%			
Firm F	33	Sales					346,73	513,69	1.415,65		-0,36
		R&D Funding			7,68	124,98	8,4	121,98			
		% Increase						48%	176%		

Firm G	13	Sales		117,85	326,56	212,89	434,29	518,82			
		R&D Funding									
		% Increase			177%	-35%	104%	19%			
Firm H	103	Sales					2.740,50	7.608,09	10.463,30	12.902,76	
		R&D Funding									
		% Increase						178%	38%	23%	

Table H.6.1 – Reasons of funding application to TÜBİTAK

Reasons	Number of Respondents	% Share
(Additional) Financial source is needed for project	63	90,00%
Funding provides prestige to the company	41	58,57%
Funding validated quality of R&D project	37	52,86%
Funding facilitates collaboration to research institutions	28	40,00%
Funding help s institutionalization of R&D	24	34,29%
Funding facilitates to reach other inner and outer resources	9	12,86%

Table H.6.2 – Difficulties encountered in funding application

Difficulties	Number of Respondents	% Share
Delay in payments	35	50,00%
Duration of assessment and monitoring process is too long	32	45,71%
No difficulty encountered	15	21,43%
Difficulty in preparation of project documents	14	20,00%
Lack of communication to external evaluators	4	5,71%
Working style of TÜBİTAK (The way of programme management)	3	4,29%
Poor assessment of projects	1	1,43%

Table H.7.1 – Approved projects in years in terms of completion date

Years	Number of Projects	Percent (%)
1998	1	0,98
1999	2	1,96
2000	4	3,92
2001	3	2,94
2002	3	2,94
2003	11	10,78
2004	14	13,73
2005	23	22,55
2006	20	19,61
2007	21	20,59
Total	102	100,00

Table H.7.2 – Rejected projects in years in terms of rejection date

Years	Number of Projects	Percent (%)
2002	3	6,38
2003	7	14,89
2004	5	10,64
2005	9	19,15
2006	9	19,15
2007	14	29,79
Total	47	100,00