ASSESSING IMPACTS OF THE EUROPEAN FRAMEWORK PROGRAMME ON TURKISH PARTICIPANTS: A CASE STUDY ON FP6 IST PRIORITY

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

HÜSEYİN METİN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
INDUSTRIAL ENGINEERING

JULY 2010

Approval of the thesis:

ASSESSING IMPACTS OF THE EUROPEAN FRAMEWORK PROGRAMME ON TURKISH PARTICIPANTS: A CASE STUDY ON FP6 IST PRIORITY

submitted by **HÜSEYİN METİN** in partial fulfillment of the requirements for the degree of **Master of Science in Industrial Engineering Department, Middle East Technical University** by,

Prof. Dr. Canan Özgen
Dean, Gradute School of **Natural and Applied Sciences** _________________

Prof. Dr. Nur Evin Özdemirel
Head of Department, **Industrial Engineering** _________________

Prof. Dr. Canan Çilingir
Supervisor, **Industrial Engineering Dept., METU** _________________

Assoc. Prof. Dr. Erkan Erdil
Co-Supervisor, **Dept. of Economics, METU** _________________

Examining Committee Members:

Assoc. Prof. Dr. Erol Sayın
Industrial Engineering Dept., METU _________________

Prof. Dr. Canan Çilingir
Industrial Engineering Dept., METU _________________

Assoc. Prof. Dr. Erkan Erdil
Dept. of Economics, METU _________________

Assoc. Prof. Dr. Barış Sürücü
Dept. of Statistics, METU _________________

M. Sc. Okan Kara
TÜBİTAK EU Framework Programmes Division Manager _________________

Date: _________________

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name	: Hüseyin METİN
Signature	:

ABSTRACT

ASSESSING IMPACTS OF THE EUROPEAN FRAMEWORK PROGRAMME ON TURKISH PARTICIPANTS: A CASE STUDY ON FP6 IST PRIORITY

METİN, Hüseyin
M.Sc., Department of Industrial Engineering
Supervisor : Prof. Dr. Canan ÇİLİNGİR
Co-Supervisor: Assoc. Prof. Dr. Erkan ERDİL

July 2010, 160 pages

This thesis aims to assess impacts of European Framework Programme for Research and Technological Development (FP) on Turkish participants, focusing on Sixth Framework Programme (FP6) Information Society Technologies (IST) priority.

A two-sided approach was employed while assessing impacts. First, DELPHI method was used to quantify and prioritise expectations of the decision makers in key stakeholders; second, a survey was designed to measure additionalities and the level of achievements of program participants. Scientific and technological impacts, economic impacts, institutional impacts and impacts on collaboration and sectoral knowledge were questioned as four main impact criteria.

It is demonstrated in survey results that, significantly high levels of impacts were achieved in scientific and technological impacts and impacts on collaborations and development of sectoral knowledge. Nonetheless, economic impacts were noted to be lowest among all impact factors.

Level of impacts were tested for different control factors including project instrument, organization type, project activity, project role and received grant. Project role was proved to be the most important control factor affecting the level of impact.

It is presented in comparison of decision makers' expectations and participants' achievements that, decision makers' expectations were mostly satisfied by participants except for economic impacts.

Turkish participants in FP6 IST field had significant impacts in three out of four main impact factors. Moreover, decision makers expectations were highly satisfied except for economic impact factors. The results of this study, relying on the assessed impacts of FP6 IST field, support Turkey's participation in forthcoming FPs.

Keywords: European Framework Programmes, Research Evaluation, Impact Assessment, R&D Subsidies, Turkey

ÖZ

AVRUPA BİRLİĞİ ÇERÇEVE PROGRAMININ TURK KATILIMCILAR ÜZERİNDEKİ ETKİ ANALİZİ: 6.ÇP BİLGİ TOPLUMU TEKNOLOJİLERİ PROGRAMI ÖRNEĞİ

METİN, Hüseyin
Yüksek Lisans, Endüstri Mühendisliği Bölümü
Tez Yöneticisi : Prof. Dr. Canan ÇİLİNGİR
Ortak Tez Yöneticisi : Doçent. Dr. Erkan ERDİL

Temmuz 2010, 160 sayfa

Bu çalışma, Avrupa Birliği Çerçeve Programlarının Türk katılımcıları üzerindeki etkilerinin Altıncı Çerçeve Programı Bilgi Toplumu Teknolojileri önceliği özelinde analiz edilmesini hedeflemektedir.

Bu etkiler analiz edilirken iki taraflı bir yaklaşım benimsenmiştir. İlk olarak, ilgili paydaşlardaki karar vericilere DELPHI metodu uygulanarak, bu kişilerin Türk ortakların elde etmeleri gereken etkiler hakkındaki beklentileri belirlenmiş; ikinci olarak katılımcılara uygulanan bir anket yolu ile, elde ettikleri etki düzeyleri ve katkılar ölçülmüştür. Bilimsel ve teknolojik etkiler, ekonomik etkiler, kurumsal etkiler ve işbirlikleri ve sektörel bilginin geliştirilmesi yönündeki etkiler, dört temel etki kriterini oluşturmaktadır.

Anket sonuçları göstermiştir ki, katılımcılar, bilimsel ve teknolojik faktörler ve işbirlikleri geliştirme ve sektör hakkındaki bilgi düzeylerini arttırma hususlarında belirgin düzeyde yüksek etkiler elde etmişlerdir. Bununla birlikte, bütün etki faktörleri içerisinde, ekonomik etkilerin en düşük seviyede olduğu gözlemlenmiştir.

Proje enstrümanı, organizasyon tipi, proje aktivitesi, proje rolü ve alınan fon miktarı gibi bazı farklı kontrol faktörleri için etki düzeyleri test edilmiştir. Proje rolünün etki düzeyini etkileyen en önemli faktör olduğu ortaya çıkmıştır.

Karar vericilerin beklentilerinin ve katılımcıların elde ettkleri katkıların karşılaştırılması göstermiştir ki, karar vericilerin beklentileri ekonomik etkiler dışında büyük ölçüde karşılanmıştır.

Türk katılımcılar, dört temel etki kriterinin üçünden yüksek etkiler elde etmişlerdir. Bunun yanında, ekonomik etki faktörleri dışında, karar vericilerin beklentilerinin yüksek oranda karşılandığı görülmüştür. Bu çalışmanın sonuçları, Altıncı Çerçeve Programı Bilgi Toplumu Teknolojileri alanı etkilerinin değerlendirilmesine dayanarak, Türkiye'nin bundan sonraki Çerçeve Programlarında yer almasını desteklemektedir.

Anahtar kelimeler: Avrupa Birliği Çerçeve Programları, Araştırma Programlarının Değerlendirilmesi, Etki Analizi, Ar-Ge Destekleri, Türkiye

To My Father

ACKNOWLEDGMENTS

The author wishes to express his deepest gratitude to his supervisor Prof. Dr. Canan Çilingir and co-supervisor Assoc. Prof. Dr. Erkan Erdil for their guidance, advice, criticism, encouragements and insight throughout the research.

The author would also like to thank Assoc. Prof. Dr. Barış Sürücü for his suggestions and comments.

I am grateful to Kübra Varol for her support and patience. She stood by me all the time and enlightened the way.

Finally, I am grateful to my mother and my two beautiful sisters for their endless patience, encouragement, support and confidence in me throughout my life. I am proud to be your son and brother.

TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

LIST OF ABBREVIATIONS

ABGS:	Secretariat General for EU Affairs
ASMI:	Annual Survey of Manufacturing Industries
CSA:	Coordination and Support Actions
DPT:	State Planning Organization
ESPRIT:	Community Research and Development Programme in the field of Information Technologies
EU:	European Union
EUREKA:	European Research Co-ordination Agency
FP:	European framework programme
GDP:	Great Domestic Product
GERD:	Gross domestic expenditure on R&D
ICT:	Information and communication technologies
IP:	Integrated Project
IPR:	Intellectual Property Rights
IST:	Information society technologies
KOSGEB:	Ministry of Industry and Trade Small and Medium Sized Enterprises Development Organization
METUTECH:	METU-Technopolis
NoE:	Network of Excellence
OECD:	Organisation for Economic Co-operation and Development
PPP:	purchasing power parity
PREST:	Policy Research in Engineering Science and Technology
R&D:	Research and development
RTD:	Research and Technological Development
SME:	Small and Medium Sized Enterprise
SPSS:	Statistical Package for the Social Sciences
STREP:	Specific Targeted Research Projects

TEKES:	Finnish Funding Agency for Technology and Innovation
TOBB:	The Union of Chambers and Commodity Exchanges of Turkey
TTGV:	Technology Development Foundation of Turkey
TURBO:	Turkish Research and Business Organizations
TÜBİTAK:	The Scientific and Technological Research Council of Turkey
TÜSİAD:	Turkish Industrialists' and Businessman's Association
U.S.:	United States
UK:	United Kingdom
VINNOVA:	Swedish Governmental Agency for Innovation Systems
VTT:	Technical Research Centre of Finland
YASED:	International Investors Association of Turkey
YÖK:	The Council of Higher Education

CHAPTER 1

INTRODUCTION

Research and development (R&D) support programmes are important part of nations' innovation systems which focus on increasing innovation levels and enhancing competitiveness. As it is in all policy instruments, policy makers desire to know what works and how to make it work better to improve their innovation systems. This stimulates a large research evaluation literature both in project, programme and program systems levels including European Framework Programmes (FP). European Framework Programme for Research and Technological Development is the main instrument for funding research in European Union with the aim of enhancing scientific and technological basis of European industry and academia, thus increasing the international competitiveness. There are a huge number of practices evaluating FP. These studies include European Commission's evaluation panels, national evaluation studies of a number of countries and also issue-based evaluations by or on behalf of principal stakeholders.

Turkey first participated to the European Framework Programmes with the Sixth Framework Programme (FP6) carried out 2002 – 2006. Being an associated country to FP6, Turkey paid a financial contribution to join to the programme and took part in the programme in equal conditions with European Union Member States. For this reason, the main public debate about Turkey's participation is usually objecting to the question "How much we paid and how much we got back?" It is clear that, evaluating Turkey's participation to FP is not only a matter of money; it is needed to assess the impacts of the programme on the participants. FP's contact organization assigned by the Turkish government, The Scientific and Technological Research Council of Turkey (TÜBİTAK) regularly prepares some reports [89] regarding Turkey's performance in FP. Although these reports include basic figures about

Turkey's performance in the programme (e.g. number of applications, success rates, participation by organization type); they do not focus on assessing impacts of FP participation on Turkish participants like its scientific and technological impacts or its impacts on sustainable collaborations. There is too little or no in depth impact analyses studies in literature dealing with Turkey's experience in FP.

The main objective of this thesis is to assess the impacts of FP6 Information Society Technologies (IST) field participation on funded Turkish organizations. We are attempting to answer several questions when we are assessing this impact. First of all, we identify key decision makers in key stakeholders in order to find out their expectations about the impacts of the programme on Turkish participants. Second, we find out the level of impacts for Turkish participants, relations between impacts and critical factors affecting the level of impact. Finally, we test compliance of decision makers' expectations and participants' achievements.

There are several reasons behind concentrating on IST field under FP6. In 1984 Community Research and Development Programme in the field of Information Technologies (ESPRIT) was launched and later this programme was called as the main pillar of First Framework Programme. Information and communication technologies (ICT) have always had important part in following FPs. In FP6, 22% of the total FP budget is for IST field [90]. High importance of this field resulted in a huge standing in research evaluation literature. Moreover, the number of applications and the number of successful projects in IST field is among the highest figures for Turkey. Improved sources of data and richer literature in the field make it possible to deal with various levels of analyses; and this is why we build on our thesis on this field. Timing for the evaluation is also appropriate since most of the FP6 IST projects have ended; in addition, it is possible to compare FP6 IST field findings with currently running FP7 ICT field.

The content of this study can be described as follows:

In Chapter II, research evaluation literature was examined. Rationales for R&D support, need for evaluation, additionality concept, impact evaluation methods and practices and national FP impact assessment and evaluation studies were discussed.

In Chapter III, we give details about Turkish experience in European Framework Programmes and some statistical figures regarding participation.

In Chapter IV, we describe the Delphi survey we conducted to find out expectations of decision makers and its results.

In Chapter V, we describe the participant survey and analyse its results. We find out level of impacts for different impact factors, we discuss relations between them, we identify effects of some control factors on impacts and finally we test how decision makers' expectations were met.

In Chapter VI, findings of this study are listed and contributions are expressed.

CHAPTER 2

RESEARCH EVALUATION LITERATURE

2.1 Rationales for R&D Support

Research and development leads to the discovery of ideas and innovations, which in turn enhance productivity and generate growth [1].

U.S. achieved a big macroeconomic success between years 1995-2000 and became a leader in high-technology after its technological acceleration before 1995 especially in Information Technology. Steil et al.[2] argue that, this was made possible by government and privately funded research universities, U.S. government agencies providing research funding based on peer review and strong tradition of patent and securities regulation.

As it is in U.S.; national innovation systems in other countries include R&D subsidies as a common policy instrument in order to attain **economic growth** and **social welfare**. In this part of the review we will go in deep about these two as rationales of government R&D support.

2.1.1. R&D and Economic Growth

With his vision of "Creative Destruction" in 1942, Schumpeter first wrote about innovation:

> The opening up of new markets, foreign or domestic, and the organizational development from the craft shop and factory to such concerns as U.S. Steel illustrate the same process of industrial mutation – if I may use that

> biological term – that incessantly revolutionizes the economic structure *from within* process of Creative Destruction is the essential fact about capitalism. It is what capitalism consists in and what every capitalist concern has got to live in. [3]

In those years "gross national product" concept was not present which later allowed economists to measure economic growth and analyze its sources, moreover to make quantitative estimates about the importance of technological advance in economic growth.

Many empirical studies starting with Solow [4], showed that a large proportion of economic growth in developed countries is attributable to improvement in technology rather than the accumulation of capital [5]. According to Solow's study, in United States gross output per man hour doubled over 1909-1949, with 87.5 per cent of the increase attributable to technical change and the remaining 12.5 per cent to increased use of capital [4]. In 1962, Arrow also identified research and development as a principle source of growth[6]. In 1990s, industrial innovation was considered as the engine of growth by Romer [7], and Aghion and Howitt [5] in their endogenous growth models.

It is now widely accepted that, R&D subsidies stimulate innovative R&D effort, and unambiguously promote economic growth [8]. Literature has supported this idea several times with empirical evidence.

Relation between R&D and productivity growth practised for 16 OECD countries[1] relying on panel data analyses pointed out that doing R&D is important for productivity and economic growth [9]. The Israeli experience is of interest because its high-tech sector boomed in the course of the 1990s, both by national and international standards [10]. Government R&D and innovation policies are perceived as crucial elements of this Israel's success story [11]. Klette et al. concentrated on a

[1] These countries: Australia, Belgium, Canada, Denmark, Spain, Finland, France, Germany, Ireland, Italy, Japan, The Netherlands, Norway, Sweden, United Kingdom, United States

number of studies and implied that four of the five studies suggest that the public R&D supports have had a positive effect on performance in the targeted firms [12],however, they also pointed out some of the shortcomings in the available studies and raised some question marks about the conclusion that these subsidy schemes have reduced market failures. According to a study, examining data on the capital-output ratio, growth of five leading research economies[2] since World War II, is because of their ability to adopt more productive technologies, not because of capital-deepening per se [13].

Growth can be sustained by continuing accumulation of the inputs that generate the positive externalities[14]. To this end, government supports aim at increasing R&D expenses of the private sector. Known as "input additionality"; this concept will be introduced further in the following sections. There are several studies in the literature mostly proving positive effects of public R&D expenditures on business R&D:

A study [15] investigating impacts of public R&D expenditure on business R&D in 17 OECD countries[3] over the period 1981-96 implied that, one dollar given to firms result in 1.7 dollars of research on average. Results of Lach's study [10] using data on Israeli manufacturing firms during 1990-1995 indicates that for the small firms, a subsidy of one unit of currency increases their R&D by about 11 units, while it had a negative effect on the R&D of large firms suggesting a shifting of R&D subsidies to small firms. Özçelik and Taymaz [16] conclude with an accelerating effect of R&D subsidies on Turkish firms financed R&D expenditures based on three panel databases: Annual Survey of Manufacturing Industries (ASMI), R&D Survey, and a database on the clients of R&D support programs.

In 1950s and 1960s, one of the main questions of growth studies was to find the answer to the question: "Can economic growth be sustained in the long run and

[2] West Germany, France, the United Kingdom, Japan, and the United States
[3] These countries: Australia, Belgium, Canada, Switzerland, Denmark, Spain, Finland, France, Germany, Ireland, Italy, Japan, The Netherlands, Norway, Sweden, United Kingdom, United States

what kind of policies can governments use to accelerate advances in living standards?" Now it is accepted that, technological change is a major factor contributing to economic growth. One of the main conclusions to emerge from this literature is that governments promote economic growth by subsidizing R&D expenditures [8].

2.1.2. R&D and Social Welfare

Second rationale of R&D subsidies is its contribution to social welfare. Improvements in technology have been a real force behind perpetually rising standards of living[14]. Social impacts of R&D have been researched over a long period.

Working group report conducted by Federal Government of Canada [17] lists social impacts of R&D expenditure as environmental enhancement, reduced health and safety risks, improvements in quality of life and improved quality and accessibility of information. Melkers and Cozzens [18] concentrates on social benefits affecting employees which are creation of new jobs, jobs retained, average salary of jobs retained and average salary of jobs created. While, Bach and Georghiou [19] evaluate the issue in a wider scope and define social benefits of R&D on quality of life like its support for cultural heritage and on control and care of the environment like reduced pollution.

It is not possible to sustain earth's fixed resources in order to produce greater outputs with today's technology and this will be an end for rising per capita incomes. If mankind continues to discover ways to produce more output (or better output) while conserving on those inputs that cannot be accumulated or regenerated, then there seems no reason why living standards cannot continue to rise for many centuries to come[14]. The revolutionary technologies improve our well-being as well as our wealth, and even can alter political systems and the international balance of power, even the most minor , contribute to economic growth by enhancing our productivity[2].

Most technological progress requires, at least at some stage, an intentional investment of resources by profit-seeking firms or entrepreneurs[14]. The motivation for the firms to conduct R&D is the monopoly rents that can be earned from a successful innovation. This will make them market leader and enjoy the earning resulted from previous research investment.

Public organizations, like universities and non-profit research institutions are bound to public funds for their activities, which will create knowledge and positively affect the private sector through collaborations and knowledge spillovers. For private organizations, Segerstrom et al. [20] model each R&D race as an "invention lottery" in which the probability of winning the race is proportional to resources devoted to R&D by each firm. This process is risky since there may be some losers ending up with already patented products after consuming their resources or with obsolete products with no economic profits. Arrow [6], showed that the amount invested by firms in research activities in a competitive framework is likely to be below the socially optimal level. This situation brings public R&D support to an important position for economic growth and social welfare.

2.2 Need for Evaluation

In previous section, we have talked about the rationales of public R&D funding which is mainly economic growth and, as a consequence, social welfare. In this part of the review, we will attempt to explain need for assessing impacts of R&D subsidies and give the recent statistics about R&D trends.

Ruegg and Feller [21] defines evaluation as follows:

> Evaluation is the systematic investigation of the value or merit of a thing or an activity. Evaluation has a long history, reportedly dating back 4,000 years to China, where it was used to assess public programs. While evaluation often is viewed as an adversarial process, it can also be viewed as a tool that not only measures, but also contributes to success.

As policy makers struggle to improve the performance of their innovation systems, and in particular to help firms in their countries become more innovative and more able to draw upon science and technology in the enhancement of their competitiveness, it is not surprising that there is a strong desire to know what works and how to make it work better[22].

Evaluation aims at answering the above mentioned questions. It can tell about performance increase or decreases; it can be used to control efficiency and quality of the outputs and compare them with the desired. Evaluation can also rise "why?" questions and appear to be a method of learning besides being a routine or documentation.

Major reasons for evaluating programs and activities are shown in Table 2.1, which may be an international management need, tool for answering stakeholder questions or an official requirement.

Table 2.1 – Why Evaluate? [21]

PURPOSE	EXAMPLE
For internal program management	Identify program activities that successfully address key program goals and outcomes
To answer stakeholder questions	Determine if the intended beneficiaries receive net benefits
To meet official requirements	Report program metrics on inputs, outputs, and outcomes
To understand specific phenomena	Assess factors that determine effective collaborations
To promote interest in and support of a program or activity	Make study results available through journal articles, reports, press releases, and presentations

Gibbons and Georghiou [23] have defined need for evaluation as “realities of economic life” in 1987 referring to the oil crises of 1973 and 1974 followed by recession, slowdown in economic activity and increase in inflation and unemployment. For most institutions, this recession has implied a period of critical review of patterns and expenditure. In an environment of declining resources, it is necessary to identify which current activities are *worth* keeping and which are to be cut back in order to allow new things to emerge. The situation is not far much different for today’s world; we are still living effects of global economic crises of 2008, and it is even more important to assure fair use of taxpayers’ money. To have a clear picture of the amount of this money we will refer to “The OECD Science, Technology and Industry Scoreboard2009” in the following part of the section.

According to this scoreboard [24]:

In 2007, R&D expenditure in the OECD area reached USD 886.3 billion (in current purchasing power parity, PPP), or about 2.29% of overall GDP. Business enterprises are the main source of R&D funding in OECD countries with a percentage of 64.5% while this percentage is 48.5 % in Turkey, 79.7 % in Luxembourg and 29.5 % in Russian Federation. In OECD countries 27.8 % of R&D financing comes directly from the governments, which corresponds to a public **R&D funding of USD 246.4 billion** in 2007 (in current purchasing power parity, PPP). This is the amount of taxpayers’ money spent in OECD countries roughly the fair use of which is studied among research evaluation and impact studies. Particularly, these studies investigate the additionality made by government R&D subsidies in terms of beneficiaries’ R&D operations. Figure 2.1 shows the R&D intensity for OECD countries. In the next section, we will present the additionality concept and its types in detail.

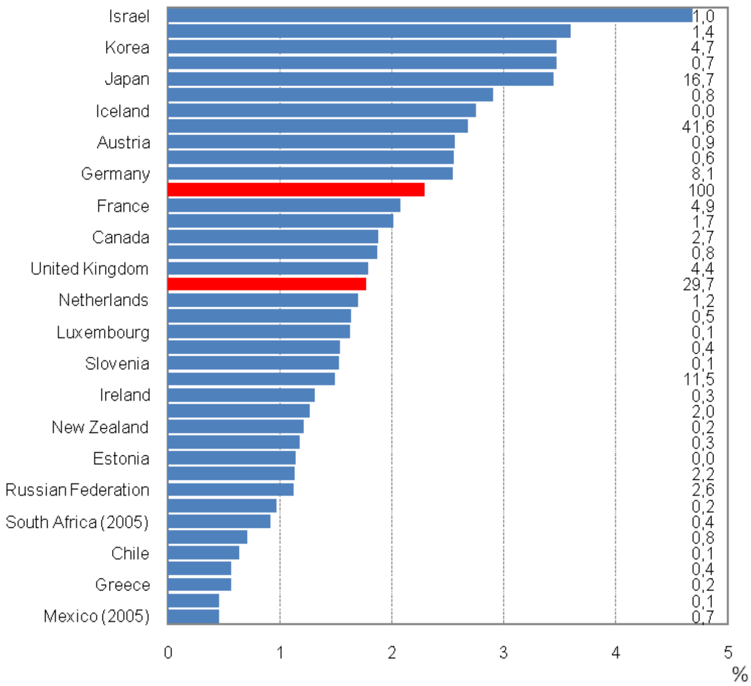

Figure 2.1. R&D intensity (GERD/GDP), 2007 or latest available year [24].

2.3 Additionality Concept:

Additionality is the difference which government-sponsored programmes have made to the recipients, particularly companies, in terms of R&D activities [25]. With the help of the concept of additionality, it could be claimed that public funds did not directly substitute for corporate investment in R&D, but were somehow additional to that which would have happened anyway[26].

The question of additionality is obviously at the heart of the justification of governments' intervention in the field of Science and Technology, and thus intrinsically linked with the rationale for the S&T policy[27].

There are three main types of additionality: input, output and behavioural additionality.

2.3.1. Input additionality:

Input additionality is the additional resources the company invests in R&D when compared with the amount it would normally invest without public funding. As illustrated in Figure 2.2, input additionality is the leverage effect adding on organization's original R&D investment. It does not only include direct public R&D funding, company pays additional currencies for R&D as a result of this leverage effect. Input additionality considers whether the funding the government provides to a firm, supplements the firm's own expenditures or substitutes for them, i.e. for every dollar, euro or yen provided by the government, does the firm spend at least an additional dollar, euro or yen on R&D, or does the government funding 'crowd out' (displace) the firm's investment [28] ? Crowd out effect is widely researched by several studies in order to find effect of public funding on private R&D spending. According to a paper comparison, additionality effects of R&D subsidies in Flanders and Germany [29] clearly indicate that the crowding-out hypothesis can be rejected. According to a study on Turkish manufacturing industry [16] crowd-out effect is not the case in this group and public R&D support significantly and positively affects private R&D investment.

Finnish researcher Jyrki implies that additionality of one euro is between 0,62 – 0,86[30]; in their study conducted in Austria Streicher et al. state that the additionality is 0,4 [31]; Guellac and Potterie indicate that it is 0,7[15] and Lach found that it is 0,41 in Israel[10]. In Turkey, Özçelik and Taymaz identified an "acceleration effect" of public funding on private R&D expenses [16].

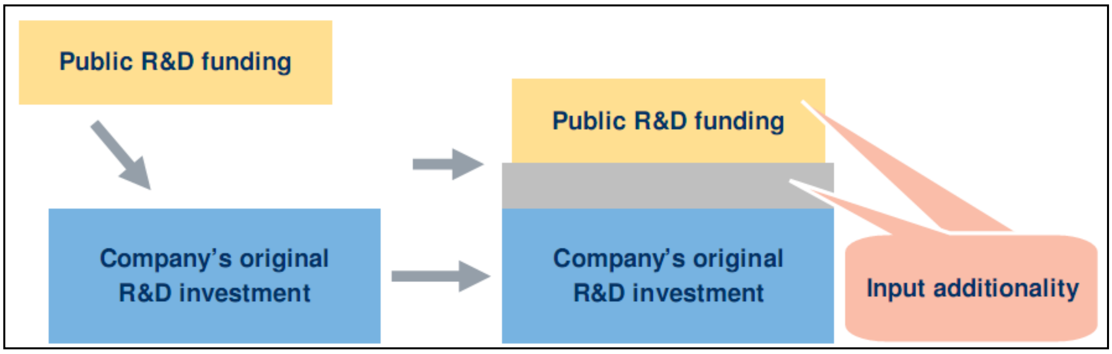

Figure 2.2. Input additionality [32]

2.3.2. Output additionality

As have been illustrated in Figure 2.3, output additionality is the proportion of the output that would not be achieved without public support. Here output is usually refers tangible gains acquired from the project as products, processes, physical devices, patents, articles, blue prints, and other forms of scientific and technological products.

Additionality in output was measured by several studies until now. According to an OECD report, panel data analysis of 16 OECD countries shows several positive effects of R&D on productivity. A study from Canada [33] points out positive effects of Canadian university R&D on size of GDP. One other study from Japan [34] discusses productivity growth resulting from R&D. A study from Flanders justifies effects of R&D on publications and patent data [35].

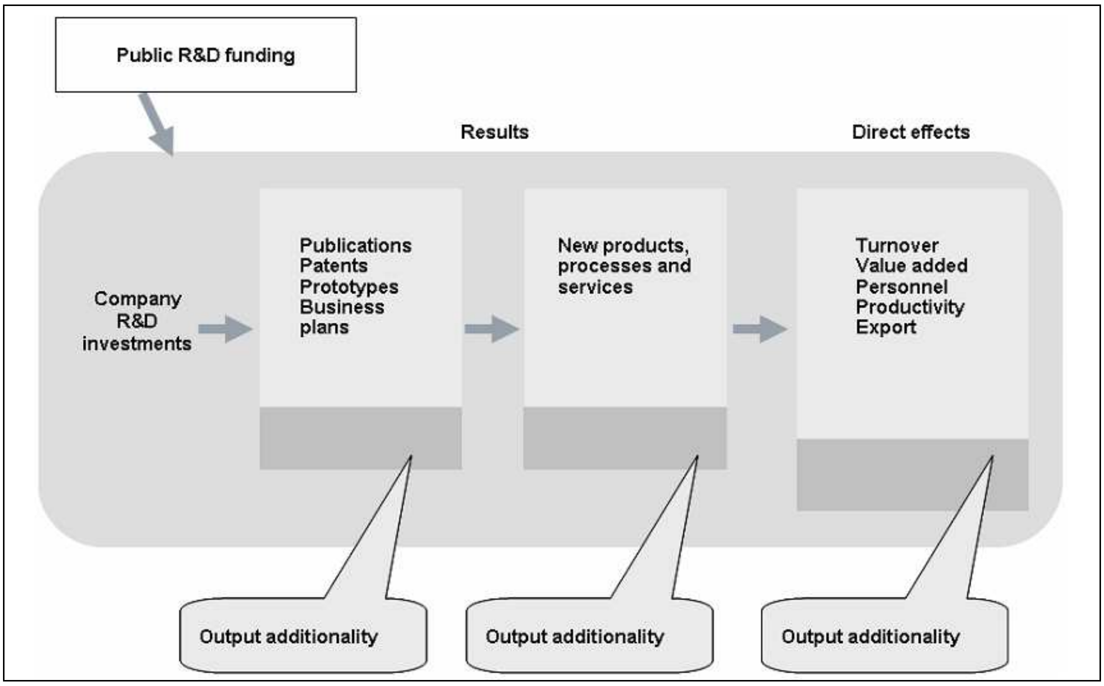

Figure 2.3 Output additionality [32]

2.3.3. Behavioural Additionality:

Behavioural additionality is a newer concept compared with input and output additionality. The concept was developed in response to empirical evaluation findings that illustrated that traditional formulations of additionality did not capture well the effects of programmes on large firms [26]. Behavioural additionality can be defined as the difference in firm behaviour resulting from a government intervention [28]. The output of a project is not always a productivity growth, patent, product, publication or similar measurable output itself. Even if the project fails to end up with concrete outputs, it will add value through learning and experience. Behavioural output may be encouragement of the firm to more innovative R&D paths, more collaboration, improved R&D management capabilities etc.

Figure 2.4 illustrates behavioural additionality in terms of its possible effects on R&D project, capabilities and competences. By the help of public subsidies, companies accelerate the completion of their R&D projects and expend their scope and scale.

They become more eager to take risks which bring more challenging and so more qualified projects. R&D subsidies have positive impact on the firm capabilities, mainly in the way they operationally manage innovation and projects. Collaborative R&D supports like FP has significant additionalities in enhancing collaboration, networking and partnerships. R&D subsidies also have effect on acquiring new competences. Enabling sooner introduction of new services and products to the market is one of them. Another competence is the increase of the number of researchers in the organization and their experience level.

Behavioural additionality is a popular topic in recent R&D evaluation studies. An OECD study performed in 2006 [28] measures behavioural additionality and emphasizes return of government R&D funding on company behaviour. Project enlargement, strategy formulation, cost-effectiveness, and commercialization behaviour are found to be main behavioural additionalities of 127 government sponsored projects in Taiwan [36]. Another study in New Zealand [37] questions how managers and policy administrators can exploit the occurrence of behavioural additionality to maximize the impact of a research policy.

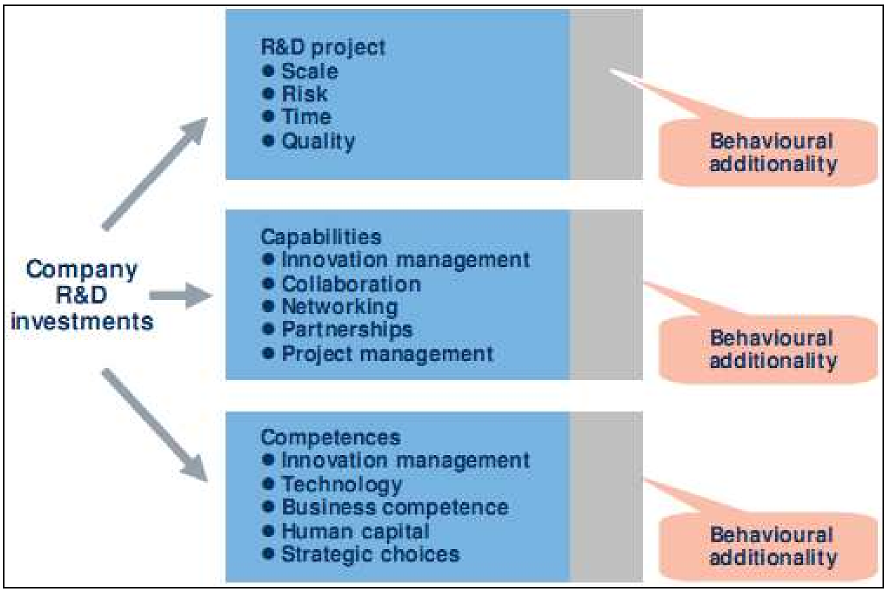

Figure 2.4. Behavioural additionality [32].

The additionality of R&D funds has been estimated by several practices occupying different tools and methods. In the following section we will go in details of those methods and practices regarding evaluation of R&D impacts.

2.4 Evaluating R&D Impacts: Methods and Practice

There is not a common perspective on research evaluation which has been agreed on. There are different approaches and classifications in different sources; here we attempt to give a brief overview of the literature about the organization of evaluation. The issue is discussed deeper in several practices like [19, 21, 23, 27, 38-44].

To plan any evaluation the necessary starting condition is clarity in terms of the **purpose** of the evaluation, of the **scope** of the activity to be evaluated and of the **criteria** to be employed[19].

The **scope** of the evaluation mainly consists of three dimensions: types of research involved, the object or level to be evaluated and the time frame[23]. Type of research aimed may be basic, applied, strategic or product oriented; more often a mixture of these. Object or analytical level to be evaluated can be distinct like macro effects of R&D spending on GDP, returns of specific technologies or direct outputs of research activities through patents and sales.

An integrated assessment scheme of Capron [40] is illustrated in Figure 2.5. Three traditional levels of analyses are possible: micro, meso and macro. These three levels respectively concentrate on project evaluation, programme evaluation and program system evaluation. These three levels are related to each other. The effects identified in micro level may provide input for meso or macro models. Moreover, findings of micro and meso evaluations will help to understand results of macro evaluation practices. For example, a single firm having R&D subsidies may experience a high increase in private R&D investment and experience market growth as a consequence. However, if the firm’s competitors adopt a submissive reaction, their R&D investment would decrease and this may have a negative cumulative effect on industry R&D investment level.

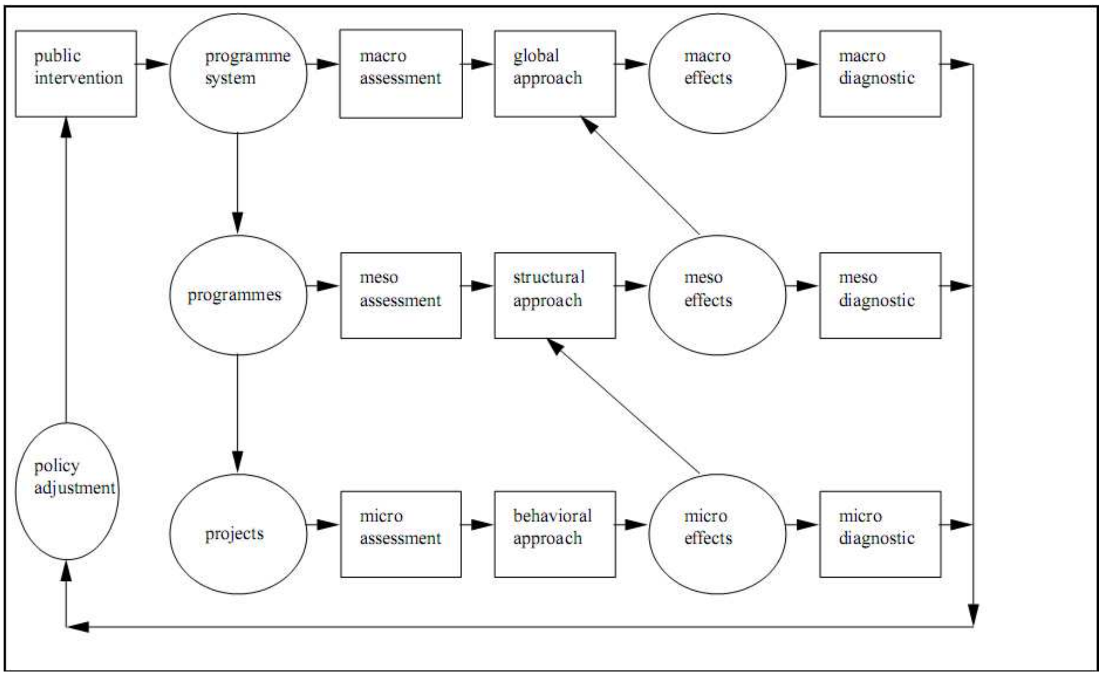

Figure 2.5. An integrated assessment scheme [40].

The evaluation can be named as ex-ante, interim or ex-post depending on the time frame within which it is to be carried out. Ex-ante evaluation is mostly a selection procedure for future policies. Methods like technometrics, systemic analysis, scenario methods or relevance trees are used in order to formulate and execute policy for research. European Commission has evaluated FP7 through an ex-ante evaluation using The NEMESIS-model[4].

[4] The NEMESIS Model is a large-scale econometric model at the macro- and sectoral levels, which has been built by a European Commission funded consortium of European research institutes. It comprises roughly 70,000 equations. All behavioural equations are econometrically estimated. http://www.nemesis-model.net

Interim evaluations are associated with the current management and accounting operations. They are usually ended up with progress reports. Peer review, screening of projects and research orientations are most common methodologies used in these kinds of evaluations.

Ex-post evaluations are most frequent application which assess the results obtained, and tries to find how resources allocated to the programme have been used to meet initial and additional objectives. The evaluation time frame is summarized in Figure 2.6.

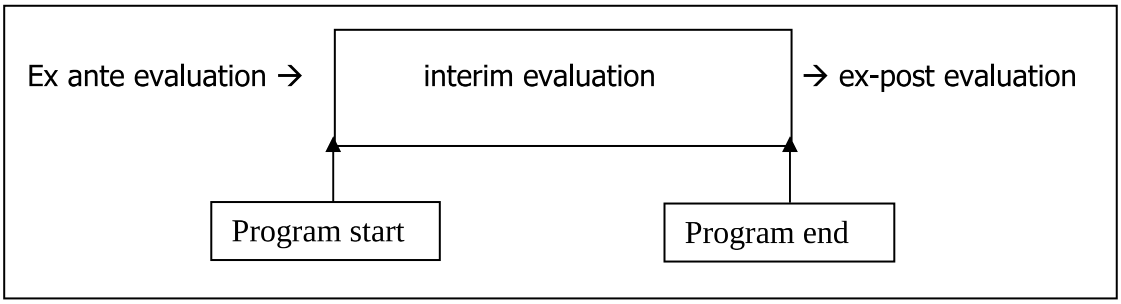

Figure 2.6. Evaluation time frame

Information needs, as well as desired impacts are different for different stakeholders, thus **purpose** of the evaluation addressed is different for different users. Project *participants* may use evaluation results as opportunity to learn and manage their resources in a more effective way or obtain evidences which can motivate senior management to maintain RTD investment. *Program managers* are interested in the cumulative impacts achieved by project participants to improve selection and management of further projects through understanding linkages between actions and effects. *Policy makers* are responsible for a higher level of aggregation to obtain value-for-money. For example, they may direct funding to strategic domains like care of old people as it is the case in European Union. While ex-ante evaluations are usually for formulation and execution of research, ex-post evaluations may have several purposes like assessing the performance of a country in an international R&D support programme; several examples of which will be presented in section 2.5.

Criteria for evaluation reflect the type of research and range from scientific excellence to economic and social benefit [23]. Most impact evaluation studies apply a combination of these. The criteria must be designed in line with scope and purpose of the evaluation. They pose the principal questions which the evaluation seeks to answer. The main R&D funding body of Turkey, The Scientific and Technological Research Council of Turkey – TÜBİTAK; mainly seeks scientific and technological research quality as its project selection criteria in The Support Programme for Scientific and Technological Research Projects (1001) yet some research focuses on effects of collaboration on firms' innovation performance[45], or additionality of public funds[29].

Steps of evaluation includes identifying scope, purpose and criteria for evaluation, formulating questions and hypothesis, determining available resources and time; furthermore choosing methods of evaluation. Choosing an appropriate evaluation method is an important issue in research evaluation. Information gathering, compiling gathered information, analyzing and interpreting results are highly dependent on these methods. There are several methods with their advantages and disadvantages. In the following section we will go in details of several evaluation methods and their practice.

2.4.1 Choosing Methods for Evaluation

Gibbson and Georghiou [23], Ruegg and Feller [21], Bozeman and Melkers [44] and Danila [38] demonstrate review about evaluation methodologies. Capron [40] distinguishes between three types of evaluation tools: qualitative methods – e.g. peer review; semi-quantitative methods – e.g. the historical tracing of scientific events; and quantitative methods – e.g. econometric and cost/benefit analyses. For the sake of simplicity we will not go for a classification and list the available methodologies and their practice.

2.4.1.1 Survey Method:

Surveys are most popular applications used in research evaluation studies. They may be used alone or they provide valuable data and information for further evaluation and different methodologies.

Surveys introduce aggregate results of a project portfolio; they do not identify individual project results. They provide statistical overview in terms of frequencies, percentages, means, medians, standard deviations, and significance of sample data.

Survey data can be collected via interviews, by phone, by mailed questionnaire and online applications. Questions may both be open/close ended questions or ranking systems like the Likert scale.

Advantages: it is an economical way of gathering information. The survey results are easy to visualize and understandable for diverse audience. The data are credible and informative, can be reanalyzed in different ways and for several purposes. Surveys provide information about participants which other methods can not like open ended question responses.

Disadvantages: Surveys cannot display richness of individual project details. The descriptive statistics are often subjective in nature. Results may be biased because of untruthful responses from participants to promote a particular point of view.

Survey methods are usually used for extracting firm-based impact, it is applicable for both ex-ante and ex-post evaluations.

A study conducted in Norway [46], evaluates the effects of an R&D programme called "The Innovation Plan" based on survey data from 54 participants tries the find how government R&D funds affect innovative performance of the firms. Mansfield [47] evaluates the effects of Canada's R&D tax credits and allowances based on a survey over 55 participant randomly selected from 1370 firms.

Sakakibara [48] examines the effect of government on R&D consortia using 34 years' data from 237 consortiums and 398 survey responses. Laredo [49] reviews the impacts of EU research policy by analyzing its effects on French participants conducting surveys to them.

It is possible to increase the number of different research evaluation survey studies aiming at different outcomes. Survey provides flexibility and makes it possible to measure lots of quantitative and qualitative target at the same time. Surveys act as a good starting point when analyzing one programme for the first time, their results usually provides input for further and more qualitative analysis.

2.4.1.2. Case Study:

Case studies are in-depth investigations into a program, project, facility, or phenomenon, usually to examine what happened, to describe the context in which it happened, to explore how and why, and to consider what would have otherwise[50]. Case studies are particularly helpful in understanding general proportions[51], and in identifying key relationships and variables. Thus, case studies can be useful in exploring effects of a new programme and quantification of benefits and costs.

2.4.1.2.1. Descriptive Case Studies

Descriptive case studies mine qualitative information from direct observations, project documents, and interviews with project actors. For more information, case studies may analyze the project or program outputs or include other methods like survey and bibliometric analyses. Case studies can also be used to construct theories about program or project dynamics[52].

*Advantages: Descriptive c*ase studies bring highly detailed information which can be more easily read by decision makers compared with quantitative studies. Case studies are much more unstructured than most other method providing richness of detail. Case studies are successful at identifying best practices and describing why a program does not work.

Disadvantages: Case studies are less convincing than quantitative analyses. Results of one case may not be acceptable for other cases.

Case studies are generally ex-post. This method can also be used in R&D value mapping [53]. One example case study is the accession countries case study presented in PREST study [27]. Here the effort is concentrated on Hungary and they made deep interviews with six organization participated in FP5 projects. International partnerships and increased prestige has been valued as two most important benefits. This study provides a useful framework for our study. The tested criteria, questionnaires would be useful. In addition, Hungary was also new to the programme in those years and shows similarities with Turkey's current situation. However, as it is already mentioned the study, the method is too much time consuming and costly. Asking just six participants is very narrow in sense, so this methodology is not preferable for us.

2.4.1.2.2. Economic Estimation Case Studies, Econometric/Statistical Methods:

Economic estimation case studies combine descriptive case data and quantificate them usually through cost-benefit analysis. The difference between the times adjusted benefits and time adjusted costs reveals the net benefits measure. These methods may also be concentrated on benefit-to-cost ratio: dividing benefits (or savings) by costs. The ratio shows how many extra benefits were earn from one unit of currency. This approach is in the hearth on input additionality studies where the money is coming from government R&D support programme.

Econometric studies estimate model parameters to structure economic relationships and using this model examines the strength of the evidence of one or more hypothesis. Many mathematical and statistical methods are used and highly quantitative results are obtained in a large application domain. These are complex methods requiring high care and skills.

Econometric and statistical methods include Hypotheses Testing, Regression and Correlation Analysis, Production Function Analysis to Measure Productivity, Macroeconomic Modelling.

Advantages: It provides more convincing quantitative results than qualitative measures. A well done economic estimation focuses on a large extend from project start to finish and gives critical information about project or programme performance. The results are valuable insights for administrators and policy makers. Evaluators can reach highly analytical capability by the help of these methods. These methods can help understanding hidden input-output relationships from complex and imperfect data. These methods provide quantitative results and they are able to demonstrate cause and affect relationships.
Disadvantages: Analyzing the economical benefits of the projects is more feasible when the projects are in existence for a longer time and when they are closer to the market. Those analyses are interested in monetary terms, thus they are concentrating on applied research and technology development programs. The method is not preferable for the basic science programmes; moreover, even it is difficult to estimate economic benefits of applied research and technology development programmes as they are distant from the market. Results may be difficult to interpret for non-specialists. These methods prove success in quantitative estimations but lack in understanding qualitative effects of programmes or projects.

Aerts and Schmidt [29] worked on input additionality and find crowd-out effects of public R&D subsidies in Flanders & German using non-parametric matching estimator and the conditional difference-in-differences estimator with repeated cross-sections (CDiDRCS). They have worked on data from more than 5000 firms and for several years. They found that the R&D intensity of German (Flemish) funded companies is 76–100% (64–91%) higher than the R&D intensity of non-funded companies. We do not have such robust data, we are seeking to test a larger number of criteria not just R&D intensity. This method would better work for evaluating Turkey's national support programmes. Another economic estimation case study is Lang's [54] who used time series data of the German manufacturing industry to estimate a variable cost function with the stock of knowledge being dependent upon current and past R&D spending. They focused on rate of return on R&D. Not all of the FP6 IST projects have ended and time is needed to see their economic effectiveness better. In this situation focusing specifically on the economic return of those projects is taught not to be feasible.

These methods are frequently used to determine how public funding affects private funding of research. A study in U.S. [55] estimated that the incremental 25 percent R&D credit been made permanent would have stimulated between $0.35 and $0.93 of additional company-funded R&D spending per each $1 of tax revenue forgone. Del Monte and Papagni [56] presents an econometric analysis of the R&D-growth of firms relation based on a database of Italian firms and shows that the sales growth rate of firms with R&D is higher than that of firms without R&D. According to a study conducted in Israel [57], subsidized Industrial R&D added 0.3% to GDP in increased productivity, each dollar of supported R&D adding an additional $0.45 to GDP and earning the economy a direct annual return of 13.4%. In a study conducted in Canada [47], using econometric models they showed that special research allowances increased R&D expenditures by 1 percent; tax credits increased it by 2 percent. Another study from Canada [33] on economic impact of Canadian university R&D has shown that the stream of new ideas and technologies stemming from universities translates into an appreciable growth in GDP and employment. Finally, an econometric study on Turkish manufacturing Industry [58] indicates that, innovations and R&D activities are crucial for the international competitiveness of Turkish manufacturing firms.

Economic estimation case studies and econometric/statistical methods are very valuable since they provide concrete and highly quantitative information about the programmes. However, sometimes it may be impossible to estimate the value of important benefits in monetary terms. Stakeholders may expect positive net benefits in the short-run, in fact, a public R&D program often takes substantial time for impacts to be realized, particularly spillover impacts resulting from knowledge dissemination EU- FP, is funding highly innovative proposals which are targeting to shape the technologies which will appear to be used in 5-10 years. On the other hand, the Turkish participants in the IST programme are mostly research organizations and universities; firm participation is quite low. None of the projects had necessary time to have concrete monetary gains; while universities and research organizations may not be targeting monetary gain instead they would be interested in scientific and technological aspects. Turkey's participation to the programme is too low to affect macroeconomic indicators; even the most successful countries like Germany, France, Sweden or Finland do not concentrate on economic returns of the project which we will see in national impact studies. Using those methods would be preferable in the further studies which will bring Turkey's evaluation efforts one step further.

2.4.1.3. Sociometric/Social Network Analysis:

In the area of research, technology and innovation policy, the promotion of "innovation networks", "competence centres" "competence networks‟ etc. is increasingly being discussed [59]. There is a wide interest on the emerging and development of social networks and their impact on economic behaviour.

Social network analysis and sociometrics helps understanding the spheres of influence of scientists, technologists, and innovators and the importance of their work, to identify evolving pathways of knowledge spillover, to improve the success of collaborative relationships, and to map the development and diffusion of human capital from projects[21].

These methods are used to identify networks of information sharing beside classical approaches like tracking citations, patents and publications. Instead, for example, they ask project participants the organizations they are in relation and share information then these people are queried and so forth. Defining such a multi-level communication network can give valuable information about knowledge spillover, area of influence and so on. Other types of approaches like co-nomination, co-authorship are also applicable. By these methods network characteristics such as number of collaborators, degrees of separation between scientists, and clustering of the network and of disciplines are described and compared[60].

Advantages: A specialized method able to bring new dimensions of innovation/economic impact analysis that are overlooked in traditional evaluation methods. It is the best model for understanding knowledge spillovers and for understanding how to form innovative networks. The method is applicable with simple data easily obtainable from common databases.

Disadvantages: These methods are not very much informative about the program performance, especially economic performance. Another disadvantage is possible unfamiliarity of the method for program stakeholders.

These methods can be used in order to identify and study the structure of relationships, for example in order to find ways to increase the diffusion of resulting knowledge. Malerba et al. [61] analyses social networks developed in IST thematic priority under FP6 provides us a good reference about network analyses. It argues that IST-RTD Programmes have a positive role in attracting key actors, in creating and increasing network connectivity, and in generating and diffusing new knowledge. Another study working on EU framework programmes [62], tried to understand how this programme shape collaborative behaviour and research productivity. Employing a panel of 294 researchers in 39 EU research networks over a 15-year period they found that while the impact of funding on productivity is generally positive the overall impact of collaboration within the funded networks is weak. Their findings also suggest that, collaborations Formed to capitalize on funding opportunities, while not effective in enhancing researcher productivity in the short run, may be an important promoter of effective collaborations in the longer run.

As it is seen in above two examples, social network analyses are very much applicable to EU FP. The highly collaborative and international structure of the programme provides a large space for those kinds of analyses. The number of the Turkish participants in FP6 IST projects is small and the time span is short. It would be hard to find tangible results from Turkey's networking patterns; on the other hand, they may also yield interesting results.

2.4.1.3. Bibliometrics: Counting, Citing, and Analyzing Content of Documents:

Publications and patents are two important outputs of research projects, databases storing this kind of information are providing a research space for bibliometric analyses. Bibliometrics, or the study of publication-based data, is one of more quantifiable methodological approaches available and has been embraced by researchers of the scientific community[44].

Simply counting publications and patents, comparing it with the cost of the project is one of the methods used to define research productivity. Tracking citations or publications and patents is another method to find pathways of knowledge spillovers. Content analysis is another branch of bibliometric which can reveal valuable information about an emerging field of knowledge or tracking research evaluation.

Advantages: The method is widely applicable since it is easy to reach related data requirements. A number of evaluations as productivity trends, collaborative relationships, patterns and knowledge dissemination are possible with this method. The results are straightforward, understandable and highly credible.

Disadvantages: Lacks putting in consideration long term effects and any other output apart from publications and patents. Time is needed for some inputs like patent information. Just examines the quantity of the output and cannot consider quality of output, for instance poor quality may be heavily cited, self-citation, and friend-citations are possible.

Over the last several decades, bibliometric studies have become widely accepted as tools for measuring scientific output[63]. One of the papers [64] presents a bibliometric assessment of the output and impact of the research activities in the field of chemistry at universities in the Netherlands during the period 1980-1991. They found that academic chemical research in the Netherlands has gained a high impact compared with a world average, and that the chemists tend to publish in high impact journals as well. Another bibliometric evaluation based on publication and patent data combined with OECD research input statistics [35] to evaluate Flemish geographical region's performance in research field. They found that Flanders is quite productive in IT as far as publication activity is concerned. Nederhos and Raan [65] compares research performances of six economics research groups to the world average by means of Journal Citation Score method.

Bibliometric is little time consuming and cheap method. It is always possible to use this method as a supporting method. Some national impact studies already gave space to this methodology. If we can prove that there is a feasible number of patents, publications emerging from FP6 IST projects with Turkish partners, this method would be applicable.

2.4.1.5. Expert Judgment

As it is in all types of evaluations, in research expert judgements play an important role. Experts are invited to give opinion written or orally about programmes, activities and results. The quality of this evaluation is limited by the scope of expert knowledge, which makes choosing true experts very crucial. Experts must be away from conflict of interest; they may perform evaluation independently or inside a panel and give their opinions as verbal quality rating or as numerical scores. There are three main types of expert review. *Peer review* usually focuses on the quality of the performed work, program or staff. *Relevance review* tests the relevance between o program and the organization's mission. *Benchmarking* evaluates an organization comparing it with a relative organization.

Advantages: Quick, straightforward, feasible and widely accepted. Gives space to interchange of ideas which can led to new perspectives.

Disadvantages: Possibility of conflict of interest, limited quality with the scope of expert knowledge.

Many government science and technology funding agencies use peer review as a primary means of selecting projects for funding[44]. Among scientists, peer review is both a social process and an ideology[66]. Expert judgements are widely used by the European Commission when they are evaluating the Framework Programme. Five-Year Assessment of the European Union Research Framework Programmes was done by an expert panel chaired by Dr. Erkki Ormala who was the Vice President, technology policy, Nokia Corporation. They reviewed the implementation and achievements of the EU Research Framework Programmes over the period 1999 – 2003 [67]. Similarly Fifth Framework Programme was evaluated by an expert panel chaired by Joan Majo including the activities between 1995-1999 [68].

Expert judgements usually evaluate the realization of the programme aims, and provide input to the programme manager. FP is a European Community programme and even old member states have little right to make changes on it. In this step, it is preferable to measure the effects of the programme on the Turkish participants instead of evaluating its administration.

In the next section we are moving to a more specialized part of the literature about research evaluation. We will see similar efforts among evaluating FP in national level. National evaluation studies will present the common research methodologies and different results from different geographies.

2.5. National European Framework Programme Impact Assessment and Evaluation Studies

International programmes have a number of forms such as bilateral agreements, intergovernmental programmes like EUREKA and international collaborative R&D programmes like European Union Framework Programmes.

In bilateral programmes responsible division in the country holds a number of bilateral research agreements with target countries in order to conduct high quality research between the two countries. In Turkey Bilateral and Multilateral Relations Division under TÜBİTAK International Cooperation Department is responsible for carrying out or monitoring the above-mentioned activities of Bilateral Cooperation and Cooperation with International Organizations.

Our study focuses on the evaluation and impact assessment of public R&D support programme "European Sixth Framework Programme – FP6" on Turkish organizations participated in Information Society Technologies (IST) Thematic Priority. So far we discussed the rationales of public R&D support, need for evaluation, additionality concept, research methodologies and practices. In this section, we will specialize a little bit more and analyse some national impact assessment and evaluation studies regarding their FP participation. These studies will offer important inputs for our study since they are similar in nature.

2.5.1. Austria

National evaluation study of Austria named "Evaluation of Austrian Participation in the 4th EU Framework Programme For Research, Technological Development and Demonstration" [69] was prepared by a consortium including Joanneum Research Forschungsges.m.b.H; Technopolis Austria; Technopolis France; 4Technopolis Ltd., UK and VTT Group for Technology Studies, Finland.

Two questionnaires were developed and sent to different groups of participants: successful group and group of rejected coordinators. A cost/benefit comparison was made. Sixty-eight percent of "newcomers" judged the benefits to be higher than the costs. In contrast, this value for the group of the "experienced" was 60%. Ranking of the most important goals and motives were asked to the participants. The participants have ranked 32 goals. In the questionnaire, the organisations were asked, if a particular result had already been attained as well as when it would be attained (if at all). Those show the tangible and intangible goals reached by the participants.

The report mainly consists of participation analysis regarding Austria, with detailed statistics. The impact assessment of the program was done just using survey method.

2.5.2. Belgium

National evaluation study of Flanders Region of Belgium named "Flanders in the European Fourth Framework Programme for Research (1994-1998)" [70] was initiated by the Ministry of Flanders; Science, Innovation and Media Department; Science and Innovation Administration.

The report does not have any dimension which deals with the impacts of the programme on participants. The report has very detailed statistical information about the participation trends of Flanders region in the Fourth Framework Programme.

2.5.3. Czech Republic

Bibliometric methods were used in evaluation of the FP-5 and FP-6 results in the Czech Republic [71]. The study proved really very positive results in publication number of participations. Citation rates are 21% higher than average, participants published papers in new fields they have never worked before; in 45 fields, more than 200% increase was observed in papers.

2.5.4. Denmark

National Evaluation study of Denmark named "Danish research co-operation in EU: Extent, return and participation"[72] was initiated by The Danish Institute for Studies in Research and Research Policy which is a government research institute under the Danish Ministry of Research.

The report is an analysis of co-operation in the FP4. First they have conducted a survey to participants asking motivates of participation. They were also asked the successful elements in the projects, showing their gains. Third dimension of the questionnaire was to find significant impact dimensions of the projects in the view of the participants. Societal effects for Denmark, types of improved competencies, new types of cooperation establishment were some other focuses of the survey.

Another survey was conducted for research managers for various participating and non-participating firms. This survey concentrated on the share of workplaces that finds motivates for participation to be in different levels of importance. It was also ranking motivates for participation in the view of non-participating firms. This showed the attitude of two different groups.

Rest of the report summarises and interprets these findings, there is no other methodology used except from the Survey Method.

2.5.5. Finland

Finland is one of the most active countries in evaluating and assessing national impact of national participation in Framework Programmes. Finland has evaluation report for all FP4, 5 and 6.

Evaluation of FP4 was done by TEKES, FP5 [73] by VTT and TEKES together and FP6 [74]by TEKES.

In FP4 one survey was mailed to each project. A total of 1169 questionnaires were sent and 70% was responded. Goal profiles for firms and non-firms, societal relevance, additionality and strategic value were gathered. Collaboration, project success, research results and impacts were asked. No other methods except from survey method were used.

In FP5 a total of 1169 questionnaires were sent and 36% was responded. The survey included similar questions as the 4th FP evaluation and included some questions regarding additionality concepts. Just survey method was used.

In FP6 a total of 956 questionnaires were sent and 33% was responded. Workshops mainly focusing on recommendations for the next Framework
Programmes as well as on producing ideas of how to better integrate EU and national level innovation policy were organized. Differently, the report includes network analyses methods maintaining valuable information about the collaboration patterns of Finnish participants.

2.5.6. Germany

The impact of European Community policies upon science and technology in Germany was analyzed by Reger and Kulhman in 1995 [75]. The study focused on the impacts of FP2 on German participants. Data bank analysis, written questionnaires, interviews with experts and steering committee discussions were occupied. 1540 surveys were sent to the participants and 586 usable replies were got. The programme was evaluated to be beneficial in increasing the knowledge base and better cooperate with European firms. It is found to be technically, scientifically and strategically useful.

By contrast, the **economic** impacts of the programme were considered to be **small**. The report says that:

> Due to the “time-lags” that elapse between project results, their incorporation in innovative or improved products, and the market introduction of these products, it has not been possible to establish **empirically** the economic benefits of the EC projects.[75]

2.5.7. Hungary

In Hungary, a narrow scoped evaluation case study was conducted on six participating firms from FP5. They were interviewed deeply and international partnerships and increased prestige has been valued as two most important benefits by the participants. The details of the study can be found in PREST report [27].

2.5.8. Ireland

The report was prepared under the chairmanship of Peter Cassells and with a huge consortium on Ireland’s FP4 participation [76].

The evaluation includes 100 survey and 53 telephone interview case study analyses. They were asked costs and benefits of participation, output ranking, additionality and some other questions. The participants seemed to have highest impacts in enhancing their knowledge base. However, few have experienced significant commercial gains.

2.5.9. Sweden

National Evaluation study of Sweden named “Impacts of EU Framework Programmes in Sweden”[77] was initiated by VINNOVA, Swedish Governmental Agency for Innovation Systems. It is an impact analysis of EU Framework Programmes for research and development at the level of industrial sectors and universities in the period 1990 to 2008. The organization of the study is quite different from other national impact studies just covering four clusters of technology and five universities. These expected to give a fair overview of overall impact. They have carried out case studies of these universities in order to understand the effects of FP participation upon their development since the start of FP3 in 1990. They also grouped projects under four technology clusters and again carried out case studies with them. The report also includes a bibliometric analysis section, from the results they conclude that no apparent effects realized in bibliometric measures.

2.5.10. Switzerland

Switzerland regularly monitors its involvement in FP preparing stocktaking reports like "Switzerland's Participation in the 6th European Research Framework Programme" [78] and "Switzerland's Participation in the 7th European Research Framework Programme, stocktaking report 2007–2008" [79].These reports do not have any dimension which deals with the impacts of the programme on participants. The reports have very detailed statistical information about the participation trends of Flanders region in the Fourth Framework Programme.

Another newly established interim report "Effects of Swiss participation in EU Research Framework Programmes" [80] makes analyses regarding the effects of FP participation of Swiss organizations. The report shows that the programme has a high output additionality on Swiss participants.

2.5.11. Norway

The name of national evaluation study of Norway is "Evaluation of Norway's participation in the European Union's 5th Framework Programme" [81] published in 2004.

The study included a survey of Norwegian participants, evaluated national support system providing guidance and assessed importance of FP for Norwegian research policy. In addition a small network analyses is also included. A survey sent to all Norwegian participations with questions on the nature of their EU-project, questions on barriers and motives to participate and questions about the effects of participation on their innovation potential. Information from the respondents to the web-survey designed for this evaluation and a series of 45 interviews constitute the backbone of the conclusions and recommendations.

2.5.12. United Kingdom

National evaluation study of United Kingdom named "The Impact of the EU Framework Programmes in the UK" [82] is an independent report for the Office of Science and Technology by Technopolis Limited.

The study focused on UK involvement in, and the impacts arising from, projects undertaken within FP4 and FP5, which operated from 1994-1998 and 1998-2002 respectively. The methodology includes a series of semi-structured interviews with representatives from participated organizations. A questionnaire survey directed to all UK participants in FP4 and FP5. Two questionnaires were used to gather (i) participants' general views on the Framework Programmes and the arrangements for FP6, and (ii) information on the outputs and impacts arising from individual FP4 and FP5 projects. They carried out ten case studies to investigate, in more detail, specific issues.

2.6 Concluding Remarks:

We have started with the review of understanding rationales of public R&D support. It is widely accepted and supported by the empirical evidence that R&D adds economic growth and social welfare. This brings public R&D support in action in order for the nations to keep their competitive position. Since R&D support is a government policy and it offers huge amounts of public money, the fair and effective use of it is object to question which brings research evaluation studies.

Table 2.2 National Evaluation Studies

		EVALUATION METHODOLOGY							
Country	**Scope**	**Case Study**	**Survey**	**Econometric /Statistic nalysis**	**Econometric estimation case study**	**Bibliometric**	**Social Network analyses**	**Expert Judgement**	**Participation statstics**
Austria	FP4		X						X
Belgium	FP4								X
Czech Republic	FP5-FP6					X			
Denmark	FP4		X						X
Finland	FP4		X						X
Finland	FP5		X						X
Finland	FP6	X	X				X		X
Germany	FP2	X	X						X
Hungary	FP5	X							
Ireland	FP4		X						X
Sweden	All FPs 1990-2008	X				X			X
Switzerland	FP6								X
Norway	FP5		X				X		
United Kingdom	FP4-FP5	X	X					X	

Evaluation studies usually attempted to find additionality of public R&D funds using different tools and methods. The methodologies used in FP national impact studies so far are listed in Table 2.2 These tools and methods have advantages and disadvantages. Since our study will be one of the first studies evaluating and assessing impact of FP on Turkish participants, we need to measure all kind of additionalities, in a timely manner. We will be evaluating FP6 IST projects' effects on Turkish participants; survey method can provide us statistical overview for this project portfolio. Moreover, the results of the survey may realize new research questions for further studies and provide input for them. Descriptive case studies are also applicable, but thinking of a portfolio of more than 50 projects, these method may be too much time consuming and expensive. However, case studies may be applicable for special project partners with more than one project.

Economic estimation case studies (cost-benefit analyses) and econometric/statistical methods (including macroeconomic and regression analyses) are highly quantitative and strong methods that can be occupied in research evaluation studies. Yet, scientific characteristics of the FP projects make it possible to see monetary effects in 5-10 years' time after project start. In addition, more than 60% of FP6 IST participants from Turkey are Universities and research organizations which rarely seek monetary gain from a project. As summarized in Table 2.2, we cannot see these methods in previous national impact studies either.

Bibliometric and social network analyses are very much applicable in evaluating FP projects thanks to its highly international structure. Small applications of these methods may be used inside our study or inside further efforts in this topic. Those two with expert judgement are the only evaluation methodologies used by national evaluation studies except from surveys so far.

As it is widely present in the literature, survey method will act as the base of our methodology. Descriptive case studies, bibliometric analyses and social network analyses can be used as supporting methodologies according to the results of survey application. Survey results will be further analysed for testing our hypotheses.

CHAPTER 3

EUROPEAN FRAMEWORK PROGRAMMES and TURKEY

3.1 European Framework Programmes at a Glance

Framework Programme is the short name for Framework Programme for Research and Technological Development which is the EU's main instrument for funding research in Europe. Those research programmes are designed to respond to Europe's employment needs, and to increase competitiveness and quality of life. With the main aim of strengthening European Research Area, Framework Programmes support high level research through multinational collaborative R&D projects, researchers' mobility, individual ideas and research capacities.

The latest, Seventh Framework Programme, will run from 2007-2013 targeting ambitious Lisbon goals of EU to be the most dynamic competitive knowledge-based economy in the world. Framework Programmes started in 1984 and will go on with Eighth Framework Programme from 2014. The structure and budgets of this programme has been improved by time as seen on Figure 3.1.

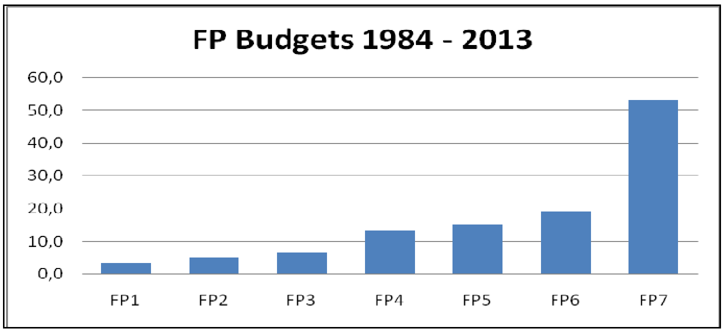

Figure 3.1. FP Budgets 1984 – 2013

Source: http://cordis.europa.eu/

Research collaboration in EU is a long tradition. CERN was founded by 12 Member States in 1954 with imagination of being a European atomic physics laboratory followed by the foundation of EURATOM in 1955 for coordinating research programmes for peaceful use of nuclear energy. COST programme which aims to sustain long-run collaboration between researchers and scientists was set in the year 1971. It was 21 December 1982 that European Council agreed on preparing Community Research and Development Programme in the field of Information Technologies known as ESPRIT which can be set as the starting point for European Framework Programmes. While research initiatives like EUREKA, ESPRIT and RACE were challenging US in technological development, research became an important political instrument for economic growth and job creation with Lisbon Strategy signed in March 2000. This date is known for launch of European Research Area. Lisbon Strategy was followed by ambitious goals of increasing national spending on R&D to 3% of GNP, of which 2/3 to come from private investment in Barcelona in 2002. This is the year Commission proposed Sixth Framework Programme, and was the first time the European Research Area was mentioned in an FP.

3.2 Turkey in European Framework Programmes

Turkey participated in FP4 and FP5 on project basis and did not make financial contribution to FP funding pool. In FP4 Turkish organizations took part in 56 projects 54 of which was in International Cooperation (INCO) programme. Between years 1998-2002 Turkey took part in projects as Mediterranean Partner Country with 94 funded participants.

FP6 was the first programme in which Turkey participated as an associated country, paying a financial contribution and taking advantage of FP in equal conditions with EU Member States.

Decision regarding Turkey's participation in FP6 was deeply discussed considering all stakeholders in 8th meeting of Supreme Council of Science and Technology on 15 April 2002 where the Council decided to take part in. Finally, Turkey participated in

FP6 as an associated state, after approval of Memorandum of Understanding in Turkish Cabinet on 29 October 2002 and publication of it on Official Gazette on 9 January 2003.

3.3 FP6 IST and Turkey's Participation in the FP6 IST thematic priority

3.3.1 FP6 IST in Brief

FP6 took place between years 2002-2006 with a budget of 17.5 billion Euros representing 4 to 5 percent of the overall expenditure on RTD in EU Member States. The objective of the program was to integrate and co-ordinate research in Europe.

As can be seen from Figure 3.2, FP6 consisted of three main blocks of activities: focusing and integrating European research, structuring the era and strengthening the foundations of era.

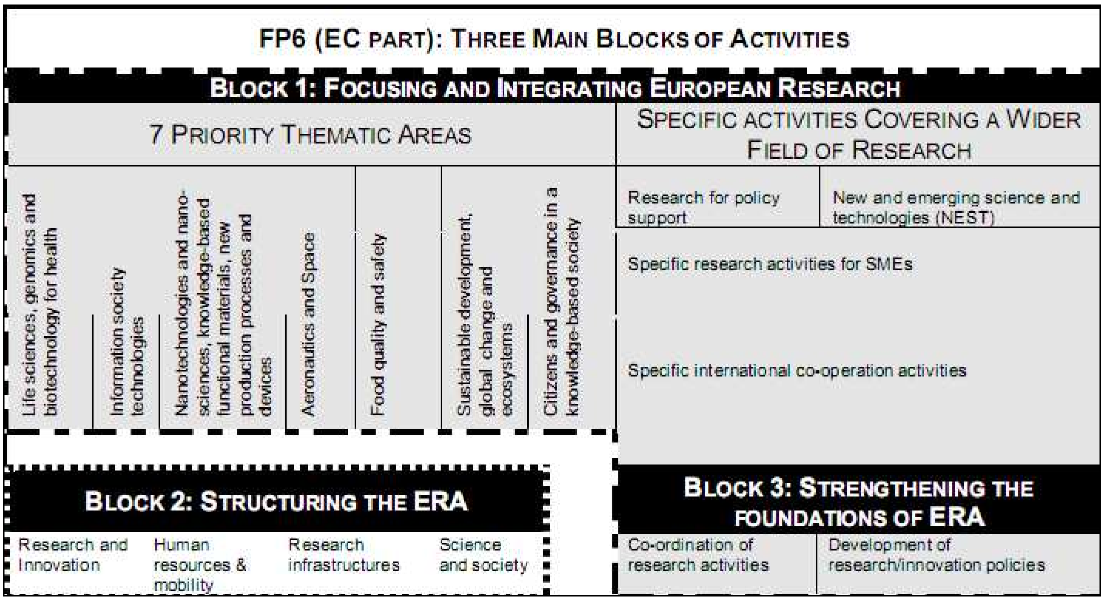

Figure 3.2: Schematic overview of the structure of FP6 [83]

IST programme stands under the first block "focusing and integrating European research" as one of the seven thematic priorities. Those seven thematic priorities[5] are the ones in which EU wants to be the most competitive, dynamic and knowledge-based economy in the world, to sustain economic growth with better jobs and social wellbeing. Main objective of the IST priority was contributing to European policies for the knowledge society and the e-Europe Action Plan; medium and long term RTD on the future generation of technologies integrating computers and networks into the everyday environment; placing the individual at the centre[83].

FP6 IST thematic priority stood for 3.6 billion Euros funding taking the biggest share from the FP6 budget as summarized in by Table 2.3.

[5] There are 10 thematic priorities in FP7 and name of IST fiels has been changed to ICT – In formation and Communication Technologies.

Table 2.3. Budget breakdown of FP6

Source: http://cordis.europa.eu/fp6/budget.htm

			(EUR million)
1. Focusing and integrating Community research			**14 682**
Thematic priorities		**12 438**	
• Life sciences, genomics and biotechnology for health.	2514		
• Information society technologies	3 984		
• Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices	1 429		
• Aeronautics and space	1 182		
• Food quality and safety	753		
• Sustainable development, global change and ecosystems	2 329		
• Citizens and governance in a knowledge-based society	247		
Specific activities covering a wider field of research		**1 409**	
• Policy support and anticipating scientific and technological needs	590		
• Horizontal research activities involving SMEs	473		
• Specific measures in support of international cooperation.	346		
Non-nuclear activities of the Joint Research Centre		**835**	
2. Structuring the European Research Area			**2 854**
Research and innovation	319		
Human resources	1 732		
Research infrastructures	715		
Science and society	88		
3. Strengthening the foundations of the European Research Area			**347**
Support for the coordination of activities	292		
Support for the coherent development of policies	55		
TOTAL			**17 883**

3.3.2 Turkey's Participation in the FP6 IST thematic priority

Success Rate:

Turkey started to take part in FP6 projects officially after January 9, 2003. Since the program has started in 2002 Turkey has missed the first and considerably biggest calls for proposals. Illustrated in Table 2.4, 687 Turkish organizations became partner in FP6 IST projects; the total number of partners is 77879 from whole Europe. 72 of those Turkish partners were funded while the total number of funded partners in Europe is 14311.

Table 2.4. Success figures for FP6 participation

	EU	**Turkey**[6]
Total number of partners	77879	687
Number of funded partners	14311	72
Success rate	18.4%	10.5%

When we analyze the figures, we can conclude that Turkey's success rate (10.5%) is lower than the European average (%18.4)[84] in IST thematic field. This situation is also valid when we look at general success figures for whole FP6 seen in Figure 3.3.

[6] The data for Turkey was taken from TÜBİTAK base on the data provided by EC for Turkey's ICT Audit Study. Some of the funded projects (eg. the ones coming from reserve lists) are not presented in the data. Moreover, there are some funded partners, which then decided not to take the fund has been included as winning partners in this table.

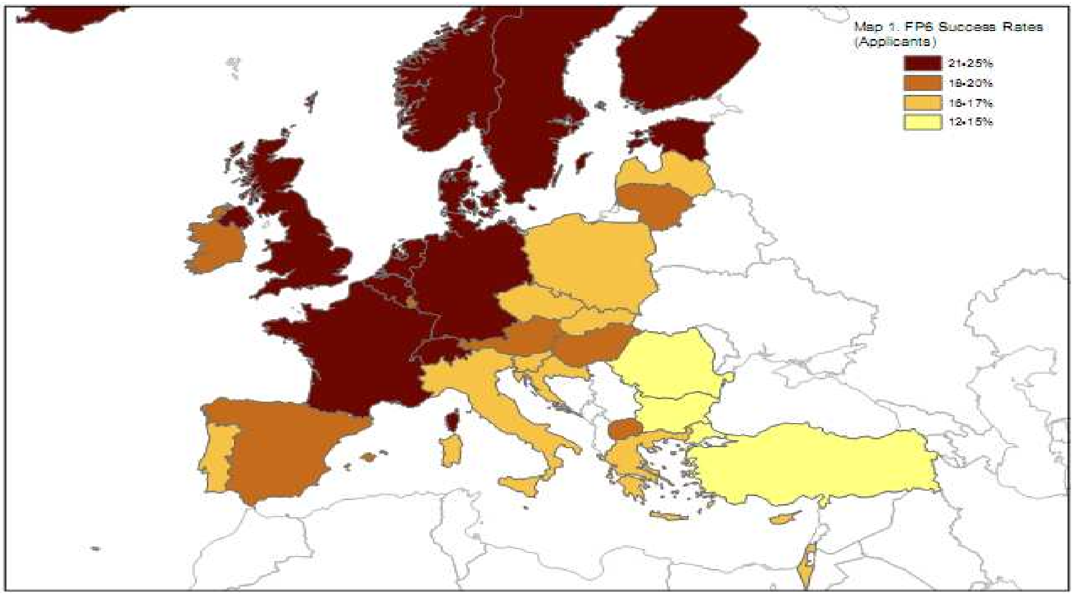

Figure 3.3. Map of FP6 success rates

Source: http://www.eurosfaire.prd.fr/7pc/doc/1215759775_fp6_final_review.pdf

Project Instrument:

There are four main project types known as instruments under FP6 IST projects. Below there is small explanation of them adopted from FP6 IST 2003-2004 Work Programme [85].

1. **Network of Excellence (NoE):** NoEs should aim at lowering barriers between hitherto split communities and disciplines and advance knowledge in the field. They should help establish and reinforce shared infrastructures, including for training and evaluation, annotation standards and appropriate usability metrics and benchmarks.
2. **Specific Targeted Research Projects (STREP):** STREPs are expected to bootstrap research in identifiable or emerging sub-domains and to prepare associated communities.

3. **Integrated Project (IP):** IPs are expected to address the objectives within a holistic approach enabling, where justified, competition within and across projects.
4. **Coordination and Support Actions (CSA):** Support to activities aimed at coordinating or supporting research activities and policies (networking, exchanges, coordination of funded projects, trans-national access to research infrastructures, studies, conferences, etc).

When assessing impact of R&D projects on Turkish participants, CSA projects shoul not be taken into consideration as they do not include research actions but include preparatory actions for future research and better integration to the programme. IP projects are bigger R&D projects led by industry with higher number of partners and budget and more ambitious goals when compared with STREP projects which are smaller in nature and trying to solve a smaller part of a bigger challenge. While NoE projects are not direct research projects this tool includes project tasks which facilitate learning and extensive knowledge spillovers in a specific research domain, thus, we will also include this instrument in analyses especially to see differentiated effects for project instruments. Table 2.5 and Figure 3.4 illustrate the funding instruments for Turkish submissions.

Table 2.5. Participation Patterns of Turkish Institutions with Regard to the Type of Project Instruments in FP6 IST

Project Instrument	Total application	Successful	Success rate (%)
CSA	136	25	18,4
IP	122	6	4,9
NoE	72	19	26,4
STP	357	22	6,2
Grand Total	687	72	10,5

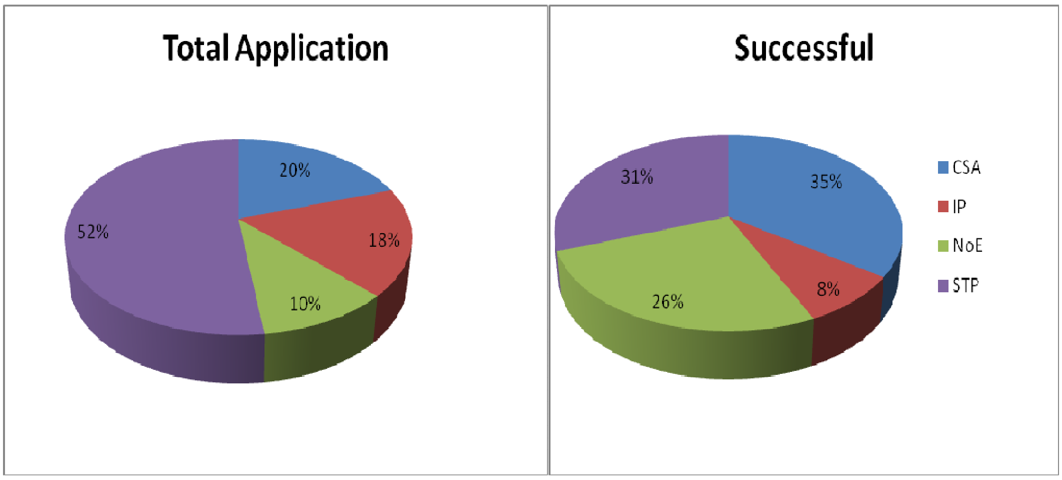

Figure 3.4. Participation Patterns of Turkish Institutions with Regard to the Type of Project Instruments in FP6 IST

Table 2.5 shows that, the success rates are lower for core R&D projects STREPS and IPs, while those generate 70% of total applications but only 39% of successful proposals. FP6 IST was calling for some special topics like "To stimulate, encourage and facilitate the participation of organisations from the New Member States (NMS) and the Associated Candidate Countries (ACC) in the activities of IST". Those topics were for new comers to FP6 like Turkey. This brought high number of application to those topics and higher succes rates. In FP7, since Turkey is no more considered as a new comer, CSA calls targetting Turkey are omitted which is expected to decreases both application numbers and success rates of Turkey in FP7. FP7 analyses will probably include higher percentage of application for STREP,IP and NoE projects and also higher share of IP and STREP projects in succesful projects, while the total success rates may decrease because of higher competition for STREPs and IPs.

Participation Geography:

Applications came from 22 different cities, 20 city from Turkey and 2 cities abroad (Gazimagusa and Nottingham[7]). Ankara (294) is the most active city in FP6 followed by İstanbul (273), Kocaeli (37), İzmir (34), Bursa (9), Antalya (8), Manisa (7), Eskişehir (6) and Kayseri (4), other 12 cities[8] have 15 applications in total. Details of geographic distribution of participation can be seen in Figure 3.5. FP7 shows a similar trend, Ankara and İstanbul are still the most active cities in FP ICT research, but the number of cities has decreased, little number of cities is being represented in FP7 ICT field.

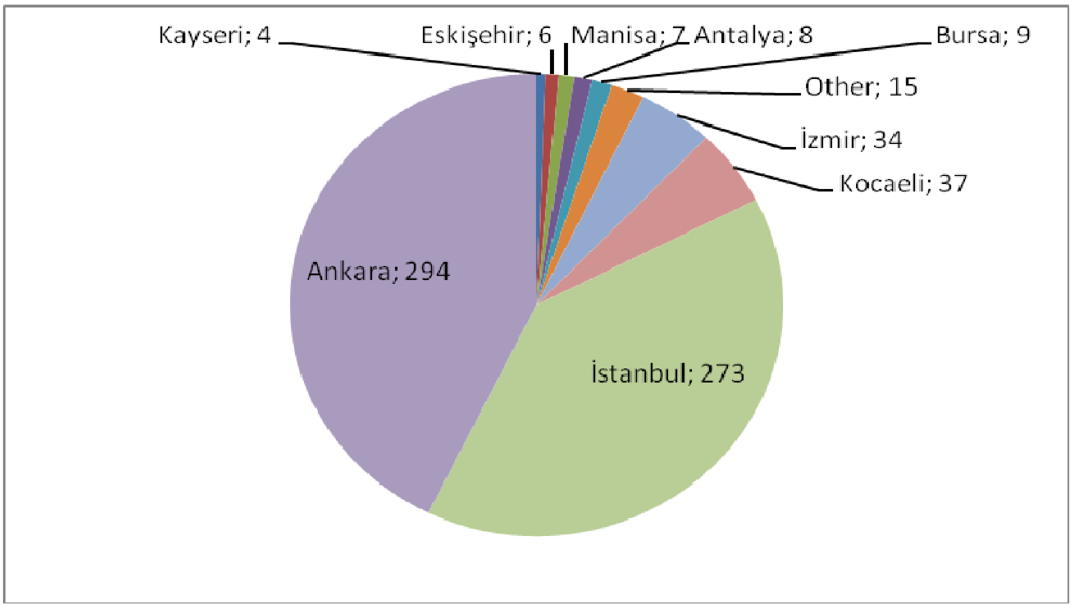

Figure 3.5. Map of FP6 IST applications

[7] This is taught to be a mistaken application
[8] Adana, Balıkasir, Isparta, Sakarya, Samsun, Sivas with one application; Aydın, Denizli, Tekirdağ with 2 applications, Gazimagusa and Nottingham with one application.

The fact that we are focusing on research projects we need to see submission figures of the cities for the projects except CSAs. Figure 3.6 shows the relevant distribution of STREP, IP and NoE projects with respect to cities.

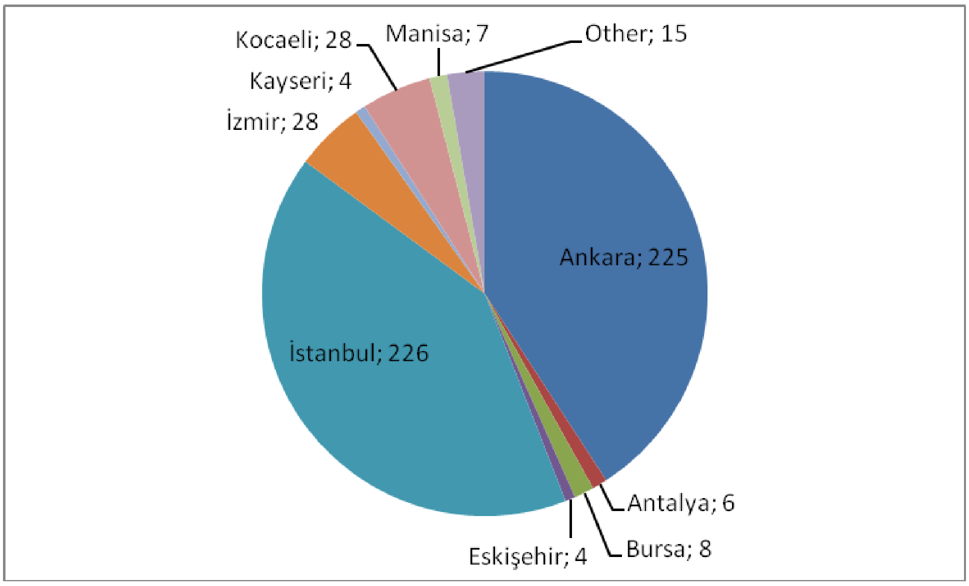

Figure 3.6. Map of FP6 IST STREP/IP/NoE applications

It is also worthy to see the geographic distribution of winning proposals. This data may give us clues about the ICT capabilities of different regions in Turkey, their international activity and network connections. Figure 3.7 includes success data both for all projects instruments and separately for only R&D projects.

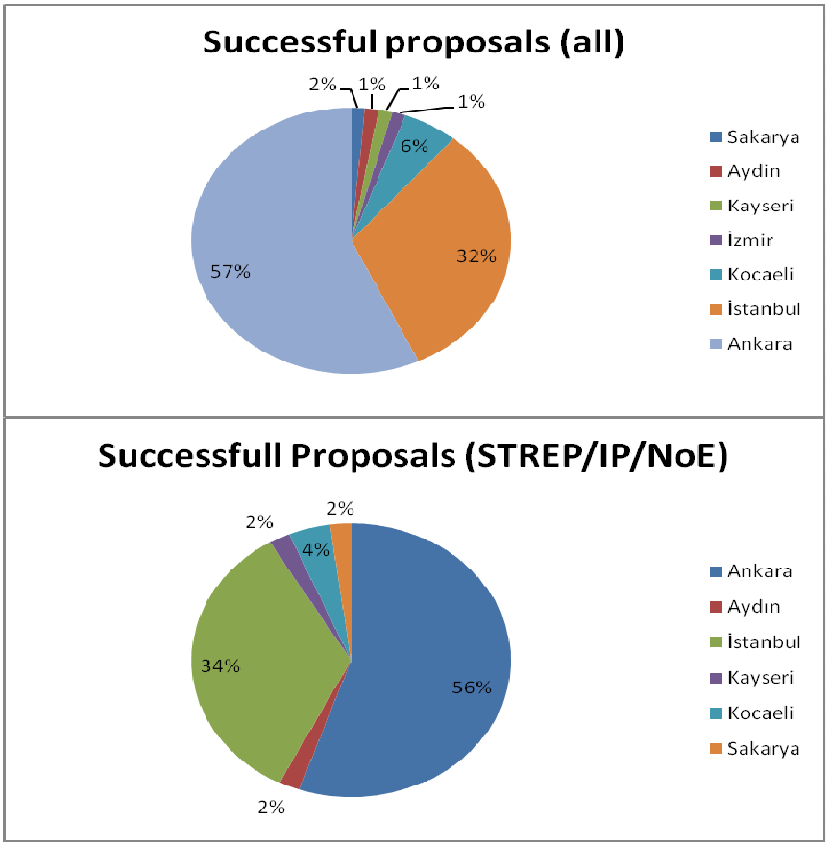

Figure 3.7. Map of successful projects with respect to geographical origin

The above numbers shows that the applications for more than 80% of the project proposals were based in Ankara and İstanbul. The awareness about FP program in these cities are higher, moreover these two cities host most competent Universities, SMEs and Industrial organizations. In any circumstances we can say that the application figures from other cities are low. FP7 figures also supports this situation, the number of different cities involved is decreasing with FP7. This may be because of the lack of excellence centres in those cities, or the organizations in those cities may have gave up following FP because of low success rates. Table 2.6 summarises the whole frame of all cities' participation in FP6 IST field revealing some valuable discussion points.

Table 2.6. Participation of cities in FP6 IST priority

City	All applications(A)	STREP/IP/NoE Applications(B)	Number of successfull (all)(C)	Number of successfull (STREP/IP/NoE) (D)	% Success rate (all) (A/C)	% Success rate (STREP/IP/NoE) (B/D)
Adana	1	1			0,0	0,0
Ankara	294	225	41	26	13,9	11,6
Antalya	8	6			0,0	0,0
Aydın	2	2	1	1	50,0	50,0
Balıkesir	1	1			0,0	0,0
Bursa	9	1			0,0	0,0
Denizli	2	8			0,0	0,0
Athens	1	2			0,0	0,0
Eskişehir	6	4			0,0	0,0
Gazimagusa	1	1			0,0	0,0
Isparta	1	1			0,0	0,0
İstanbul	273	226	23	16	8,4	7,1
İzmir	34	28	1		2,9	0,0
Kayseri	4	4	1	1	25,0	25,0
Kocaeli	37	28	4	2	10,8	7,1
Manisa	7	7			0,0	0,0
Nottingham	1	1			0,0	0,0
Sakarya	1	1	1	1	100,0	100,0
Samsun	1	1			0,0	0,0
Sivas	1	1			0,0	0,0
Tekirdağ	2	2			0,0	0,0
Grand Total	687	551	72	47	10,5	8,5

Success rates for STREP, IP and NoE projects are lower for all cities as expected. Success rates for Aydın and Sakarya are very high since they have small number of applications and high success showing the importance of being in true consortiums.

Organization Types:

In this study, we have divided he participants into five major organization types[9]. Higher education institutions (HEI), small and medium sized enterprises (industrial organizations)(SME), big industrial organizations, which cannot be listed as SMEs according to EU SME description (BIG), research centres like TÜBİTAK Institutions

[9] The division was made according to application database, the real figures may be slighly different because of the mistaken applications.

(RES), and others including associations, ministries and other nongovernmental organizations (OTH). The data shows that 312 out of 687 project applications come from higher education institutes, so as to say from universities. It is followed by SMEs, research centres, big industrial organizations and other type of organizations shown on Figure 3.8.

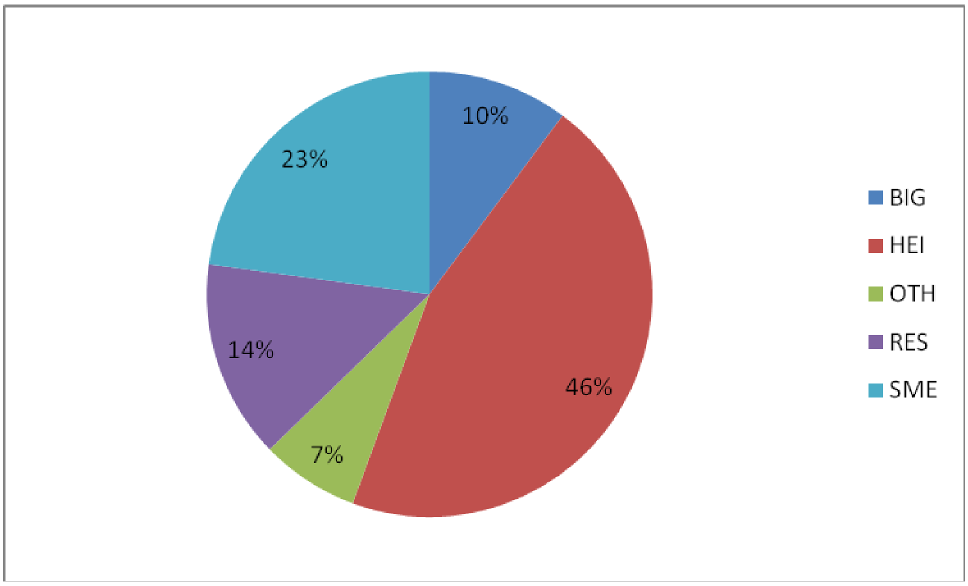

Figure 3.8. FP6 IST field applications with respect to organization types

CHAPTER 4

DELPHI SURVEY

4.1 Scope of the Study

This thesis is seeking the answer for the following question:

What are the impacts of FP6 IST Programme participation on Turkish organization?

As its impact on participating organizations stays at the centre of our work, expectations of main stakeholders (e.g. related ministries, councils, associations etc.) and to what extent those expectations were satisfied generates the second most important research question. We preferred to employ a two-sided approach while we are assessing impacts of FP6 IST programme on Turkish participants. We have discussed available evaluation methodologies,, previous methods used for FP impact assessment in other countries and in section 2.5 we concluded that survey method would be the best method to measure all kind of additionalities, in a timely manner. Thus, in the first part of our study, we used DELPHI method to quantify and prioritise expectations of the decision makers in key stakeholders, in the second part we designed a a survey for program participants This approach also provided us with the information to see how much of the expectations have been realized.

We conducted Delphi surveys to the main Decision makers in important stakeholder organizations. We forced them to distribute 100 points to 49 impact factors reflecting the level of their expectations. The Delphi data visualized expectations of those stakeholders about the impacts of the programme on Turkish participants.

To collect opinion of participants about the impact they have achieved from the projects we designed a participant survey including 19 main question and 71 sub-questions. The questions were for addressing three main targets: measuring satisfaction levels of participants in four main impact criteria, measuring level of the additionalities and to find out certain implicit facts about participants. ??

First survey question includes 47 Likert scale sub-questions in order to measure participants' level of satisfaction in our four main impact criteria, namely scientific and technological impacts, economic impacts, impacts on collaborations and sectoral knowledge and other institutional impacts.

There were a number of questions which were aiming at evaluating the levels of three different additionalities.

We also added some questions in order to find out implicit control factors to test their effects on impacts.

Survey data were analyzed to show some descriptive statistics about impacts, to find correlations between impact factors and to compare means of impacts with respect to control factors.

To sum up, we used two sources of data 1) DELPHI study with 19 research directors, national experts and governmental representatives, 2) a survey of 34 Turkish participants in FP6 IST research projects.

The outputs of this effort were used for:

- Identifying main impact criteria we would like to evaluate
- Finding out the level of impacts achieved by Turkish participants
- Understanding correlation between different impacts

- Finding out critical factors affecting the level of impact like organization type, project type, project role etc
- Finding out additionality of the programme
- Examining the expectations of decision makers from critical institutions
- Testing the compliance of decision makers' expectations and participants achievements

In order to understand to what extends the decision makers' expectations were met, it was needed to find out implicit opinions of the decision makers' about the importance of the impact factors. We used Delphi method for this aim. The Delphi method has proven to be a popular tool for identifying and prioritizing issues for managerial decision making [86]. This method has also been used in similar studies like "Innovations for our Future. Delphi '98: New Foresight on Science and Technology" study conducted in Germany[43].

This thesis bases on a Delphi study designed to rank all impact factors of participating in FP6 IST field. We gave decision makers 100 points to be assigned each one of 49 impact factors. Delphi study was conducted before the participant survey. Those 49 impact factors almost coincides with 47 impact factors under participant survey; we just made some simple changes on the impact factors and deleted some which are very close to each other before we design participant survey. Since it was a very time consuming issue to get proper and timely reactions from high level positions in key institutes we applied Delphi for just one round. The Delphi survey can be seen from the Appendix A, we conducted the survey online.

4.2 Delphi participants

Delphi surveys were sent key persons in key organizations which are taught to be main stakeholders of the FP6 IST programme. We asked them to fill in the survey so as to reflect their organizations' view. Delphi surveys were sent online after connecting participants via telephone. First surveys were sent on December 2009 and the process ended in March 2010. Profiles of 19 survey participants are listed below, we will not give the personal information about the people conducted the survey.

TÜBİTAK: The Scientific and Technological Research Council of Turkey (TÜBİTAK) is the leading agency for management, funding and conduct of research in Turkey. Since TÜBİTAK is responsible from the coordination of FP in Turkey, they have the highest knowledge and experience about the issue. Delphi study includes four participants from TÜBİTAK. Two of them are in managerial positions in Science, Technology and Innovation Policy Department and EU Framework Programmes Division. Two other participants are more close to the operational issues of the programme; one is ICT National Contact Point of Turkey for the programme and other is following ICT Programme Committee meetings.

DPT: State Planning Organization. Director of Information Society Department took part in this study. DPT is also responsible for coordination of the European funding programme ICT Policy Support Programme (or **ICT PSP**) aims at stimulating innovation and competitiveness through the wider uptake and best use of ICT by citizens.

Republic of Turkey Ministry of Finance: This ministry is closely related with the financial contribution of Turkey to the programme. Director of Strategy Development Unit contributed to our Delphi survey.

TOBB: The Union of Chambers and Commodity Exchanges of Turkey is the highest legal entity in Turkey representing the private sector. Director of Information Services Unit contributed to our survey.

KOSGEB: Ministry of Industry and Trade Small and Medium Sized Enterprises Development Organization. Former vice president contributed to our survey.

TTGV: Technology Development Foundation of Turkey, works for the mission of supporting the development of technological innovation capacity of Turkish industry, which will improve international competitive position of Turkey. General Secretary contributed to our survey.

YÖK: The Council of Higher Education. It is a fully autonomous supreme corporate public body responsible for the planning, coordination, governance and supervision of higher education. One of the Executive Board Members contributed to our survey.

Delegation of the European Union to Turkey: Delegation of the European Union to Turkey represents the European Commission on the diplomatic and political level. Sector Manager for Infrastructure and Research contributed to our Delphi.

ABGS: Secretariat General for EU Affairs is responsible for accession negotiations with Turkey. Social, Regional and Innovative Policies Expert contributed to our survey.

TÜSİAD: Turkish Industrialists' and Businessman's Association. TÜSİAD is a voluntary based civil society organisation founded by Turkish industrialists and businessmen in 1971 with the objective of representing the business world. An expert from Information Society and New Technologies Department contributed to our survey.

METUTECH: Supports the formation and development of high-tech using-producing firms to ensure the development of technology, and to maximize the university-industry cooperation. The Delphi survey was sent to the director.

TURKCELL: Leading mobile operator in Turkey. FP contact point for Turkcell contributed to our survey.

SRDC: An SME working in the field of ICT and very experienced in FP. Director contributed to our survey.

TURBO: TURBO is an international non-profit association (a.i.s.b.l.) set up in Brussels by the public and private sector institutions and represents the Turkish research and business domains, i.e. TUBITAK (Scientific and Technological Research Council of Turkey), TOBB (The Union of Chambers and Commodity Exchanges of Turkey), KOSGEB (Small and Medium Enterprises Development Organization) and TESK (The Confederation of Turkish Tradesmen and Craftsmen). Director of TURBO contributed to our survey.

YASED: International Investors Association of Turkey, founded in 1980, is a non-profit, private sector organization whose members are international companies operating in Turkey. President of R&D Working Group contributed to our survey.

KOÇ Holding: One of the largest and most successful group companies in Turkey. Koç Group Strategic Planning Technology Consultant contributed to our Delphi.

We asked the above mentioned 19 representatives from first hand stakeholders for the FP6 IST field to divide 100 points to 49 different impact factors according to the importance level of those factors. We had the following results.

4.3 Analyses of the Delphi results

First of all we asked decision makers to grade four main impact factors according to their priorities. They were encouraged to check all subtopics and all 49 effects and outputs listed under those factors before they evaluate. Their ranking can be seen from Figure 4.1.

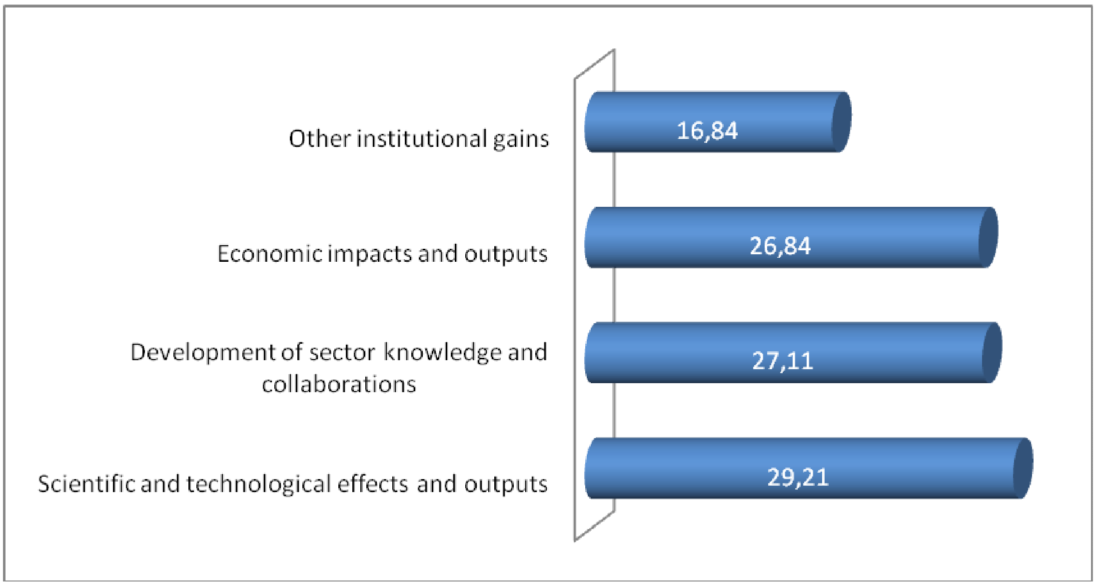

Figure 4.1 Delphi ranking for main impact factors

Decision makers evaluated and graded scientific and technological effects and outputs as the most important possible outcome of FP6 IST field. We can conclude that, for decision makers, FP6 IST programme should increase partners' scientific and technological capabilities above all. Second priority of the decision makers is FP6 IST field's effect on development of sectoral knowledge and collaborations. Delphi participants were well aware of the dynamics of the programme and they see networking as an important part of research. These two followed by economic impacts of the programme, although they do not see economic impact as the most important result of a FP6 IST project, they still think that it is important and they scored it almost as high as first two elements. Although we have realized high impact for other institutional gains from FP6 IST programme, it has far low scores from decision makers. They know that FP6 ICT field may result with such positive impacts; however they do not see these kinds of impacts as crucial outcomes of FP6 IST field.

Second we asked decision makers to distribute the points they have given to these four main factors to their subtopics.

There are four subtopics under scientific and technological heading as seen from Figure 4.2. Decision makers think that acquiring new technological knowhow like new scientific knowledge, methods and better technologies are the most important scientific and technological factors. They are followed by the business outputs like software, prototypes and standards and norms. Developing new technical and technological, managerial or marketing skills evaluated to be third most important element. Scientific outputs like patents or scientific publications seem to be least important scientific and technological outputs for decision makers. Ranked final scores for all impact factors are listed in Table 4.1.

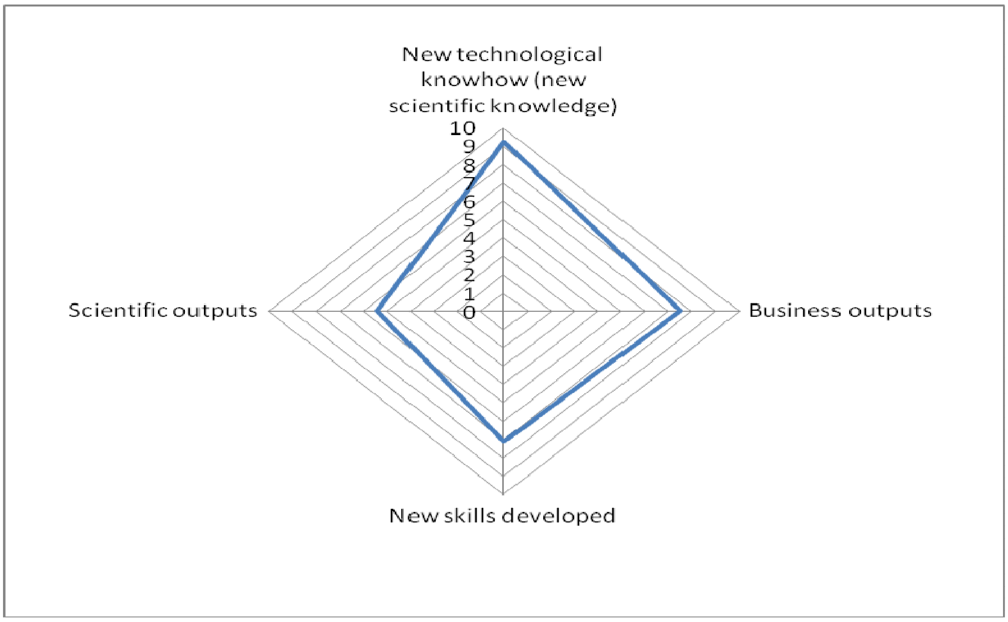

Figure 4.2. Radar chart for Delphi scores in scientific and technological impact factors

Table 4.1 Delphi ranking for scientific and technological factors.

New technology acquired from the project (learning or formal technology transfer)	3,67
New Technical and technological skills	3,24
New or substantially improved research methods or equipment	3,07
Prototypes	2,57
Software	2,52
New scientific knowledge	2,47
Norms and/or standards	2,42
# of patents or other forms of IPR rights	2,16
New Managerial Skills	2,00
New Marketing skills	1,85
# Other forms of dissemination (organized workshops, conferences...)	1,77
# of publications derived from the project	1,46

There are four subtopics under economic impacts heading. The most important one was considered to be the improvements in the participants' products and services or brand new products. Second, decision makers think that, the projects must enhance participants' competitive position. These two is followed by change in productivity and access to new financial resources (Figure 4.3). Ranked final scores for this heading are seen on Table 4.2.

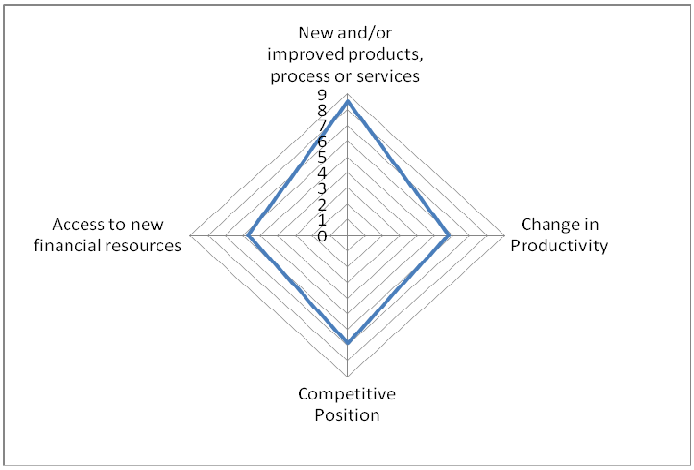

Figure 4.3 Radar chart for Delphi scores in economic impact factors

Table 4.2 Delphi ranking for economic factors.

2.1.1. New product formation	3,69
2.4.2. Financial input from commercialization of the research results	3,08
2.2.1. Increase of productivity	3,05
2.2.2. New or substantially improved production processes	2,74
2.1.2. Qualitative improvements in products	2,64
2.4.1. Research funding	2,57
2.1.3. Adding new feature into existing product	2,19
2.3.2. Access to new international markets	2,08
2.3.4. Increase in exports	2,00
2.3.3. Increase in sales	1,59
2.3.1. Access to new domestic markets	1,21

Development of sector knowledge and collaborations have only two subtopics. Setting new partnerships and as a consequence finding new contacts, deepening collaborations and sharing risks was ranked first by 15 point. Acquiring new knowledge on existing future markets and technologies via new memberships to research networks and monitoring competitors had 12.2 points and ranked second. Final scores for this heading are listed in Table 4.3.

Table 4.3 Delphi ranking for collaborations and sectoral knowledge factors.

3.1.2. Monitoring Competitors (attended fairs, memberships...)	5,58
3.1.1.1. Membership to European Technology Platforms and other related umbrella organizations	4,29
3.2.1. New contacts	3,62
3.2.3. Sharing risk and cost of R&D	3,50
3.2.4.2. New contacts for international projects (CP, EUREKA..)	3,36
3.2.2. Deepening of collaboration	2,98
3.1.1.2. Memberships to ICT related nongovernmental organizations	2,31
3.2.4.1. New contacts for national projects (TEYDEB, TTGV..)	1,47

Institutional gains had the least score with its five subtopics: human resources, infrastructure development, increase in organizational prestige, learning about EU programmes and increase in organizational R&D awareness. Their respective scores are illustrated in Figure 4.4.

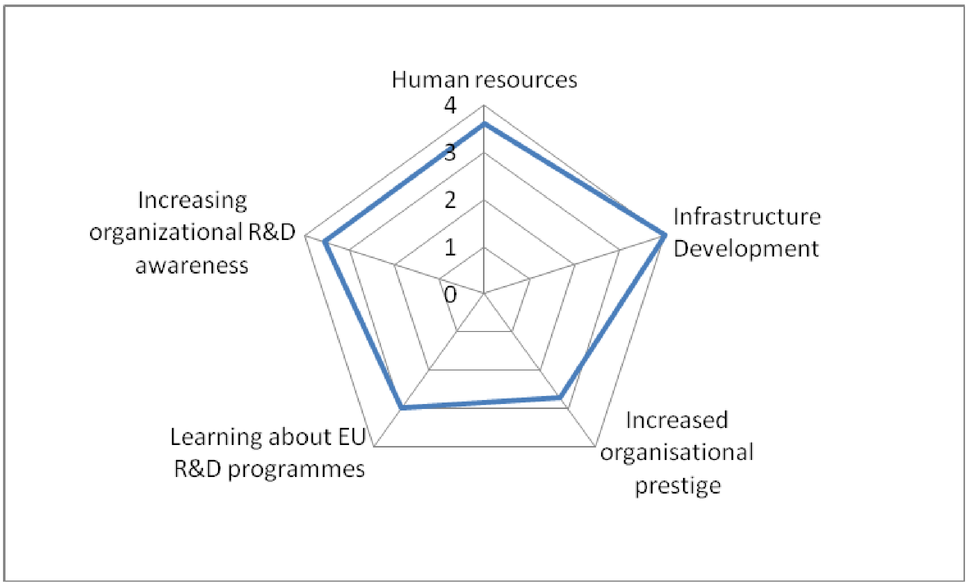

Figure 4.4 Radar chart for other institutional impact factors.

Decision makers value infrastructure development as the most important institutional gain resulting from FP6 IST projects. It is followed by ehnacement in human resources and increase in R&D awareness. Learning about EU R&D programmes is ranked fourth. Althouh we have seen that institutions increased their prestige highly by FP projects, it is not seen to be so important by decision makers. Final scores for all factors are listed in Table 4.4.

Table 4.4 Delphi ranking for collaborations and sectoral knowledge factors.

4.3.2. added visibility for the organization	1,73
4.1.1. Training of personal	1,59
4.2.2. Foundation of an R&D laboratory for a specific research topic	1,43
4.2.3. Purchase of equipment	1,32
4.2.1. Foundation of an R&D laboratory during the project	1,25
4.3.1. gaining prestige for the organization	1,25
4.5.3. Increase in the number of R&D personnel	1,07
4.4.3. Learning how to manage international R&D programmes	1,07
4.1.2. Increase in post-graduate degree personal because of the project	1,00
4.5.2. Increased awareness about R&D studies	0,93
4.5.1. Increase in R&D investment	0,87
4.4.1. Learning about EU funding opportunities	0,69
4.5.4. Establishment of a new R&D department	0,69
4.4.2.2. Learning International project preperation	0,60
4.1.3.2. New technological employment positions	0,48
4.4.2.1. Learning national project preperation	0,35
4.1.3.1. New managerial employment positions	0,32
4.1.3.3. New support services employment positions	0,22

The Delphi survey implies that, decision makers were highly demanding in the scientific and technological impacts and impacts on collaboration and sectoral knowledge. With a very small difference it is followed by economic impacts. Decision makers tend to value other institutional impacts to be the least desired achievements from FP6 IST participation. In Chapter V, we focus on actual achievements got by project participants. Furthermore, we compare expectations with the real achievements.

CHAPTER 5

PARTICIPANT SURVEY

The survey data was collected from March 2010 to May 2010 by an online questionnaire[10] conducted to all Turkish participants in FP6 IST R&D projects based on database of the European Commission. European Commission database includes 47 partners funded in FP6 IST priority. When 47 organizations were examined, it was noticed that two of the partners have been excluded from the project during negotiations and one of the projects has never started. Thus the number of funded organizations has decreased to 44. We were not able to contact three of the participants because of several reasons like important structural changes in the organizations or mobility of staff. Seven contacted participants did not fill in our questionnaire although we have also contacted them by phone. To this end, our analyses base on 34 participant survey out of a total 44 funded organizations with a response rate of %77.3. List of 34 participants can be seen in Appendix D.

34 participants come from 6 different cities; Ankara has the biggest share with a percentage of 58.8% as can be seen from Table 5.1.

[10] http://www.surveey.com/SurveyStart.aspx?lang=1&surv=e5j5msj503ncs5118jnoot4mo6f5ihy1

Table 5.1. Profile of responses – City

City	**Frequency**	**Percent**
Ankara	20	58,8
İstanbul	10	29,4
Kocaeli	1	2,9
Sakarya	1	2,9
Aydın	1	2,9
Kayseri	1	2,9
Total	34	100,0

As depicted by Table 5.2, from the three R&D project instruments, responses mostly came from STREP and NoE proposals. Participation in IP projects is lower, as it is in overall success rate.

Table 5.2. Profile of responses – Project Instrument

Instrument	**Frequency**	**Percent**
STREP	15	44,1
IP	6	17,6
NoE	13	38,2
Total	34	100,0

21 of the 34 participants come from Universities; it is followed by SMEs as summarized in Table 5.3.

Table 5.3. Profile of responses – Organization Type

Type	Frequency	Percent
HEI	21	61,8
BIG	1	2,9
SME	11	32,4
RDI	1	2,9
Total	34	100,0

5.1 Survey Design

Participant survey can be found in Appendix B and online[10]. This survey has been designed to gather information about three different aspects of participation dynamics. First of all we attempt to have information about the **target impacts** we are trying to measure. Second, we would like to see effects of participation with respect to three **additionality** types. Finally, there are some **control facts** we would like to know which is not provided in European Commission's database, like the role of the participant in the project, type of activities they dealt with etc.

5.1.1 Four Main Impact Criteria

The literature the targeted impacts are defined in different ways for almost all evaluation studies. Depending on the aim of the evaluation a set of different criteria may be examined.

Table 5.4. COMEVAL Toolkit, taxonomies of impact [19]

Outputs		**Impacts/effects**	
Intermediate outputs	prototypes	Competitiveness	sales
	technological sub-systems		market share
	demonstrations		open up markets
	models/simulators		create new markets
	integration of technologies		lower costs
	tools/techniques/methods		faster time to market
	intellectual property		licence income
	decisions on further RTD	Employment	jobs created
Products	new products		jobs in regions of high unemployment
	improved products		jobs secured
Processes	new processes		jobs lost
	improved processes	Organisation	formation of new firm
Services	new services		joint venture to exploit results
	improved services		new technological networks/contacts
	processes for delivering		new market networks/contacts
	services		improved capacity to absorb knowledge
Standards	de facto standard		core competence improvement
	de jure standard		further RTD
	reference		change in strategy
	conformance		reorganisation of firm to exploit results
	memoranda of understanding		increased profile
	common	Quality of life	healthcare
	specification		safety
	code of practice		social development & services
	identified need for		improved border protection & policing
	change		support for cultural heritage
Knowledge and skills	management & organisation	Control & care of the	reduced pollution
	technical	environment	improved information on pollution & hazards
Dissemination	training activities		reduced raw material use
	workshops/seminars/		reduced energy consumption
	conferences		positive impact upon global climate
	technology transfer activities		decrease in pollutants
	knowledge & skills transfer	Cohesion	employment in LFRs
	publication/documentation		infrastructure of LFRs
			participation of LFRs further
			RTD in LFRs regulation and
			policy in LFRs
		Development	transport
		infrastructure	telecommunication
			s urban
			development rural
		Production & rational	energy savings
		use of energy	renewable sources
			nuclear safety assurance
			of future supply
			distribution of energy
		Industrial	development of internal market
		development	development of SME sector
			development of large
			organisations support for trade
		Regulation & policy	EU regulations or policy national regulations
			or policy world-wide regulations or policy
			co-ordination between national &
			Community RTD programmes

Table 5.4 above shows the list of possible impacts of research, derived from the COMEVAL (Common Methodology for the Evaluation of RTD Results) Toolkit, which is a project-level toolkit used by European Commission. COMEVAL is not accepted to be the best taxonomy; we list it because it is one of the longest lists available.

Switzerland's national impact study [80] concentrates on four main impact criteria which are effects on support for research, effects on economy and environment, effects on scientific collaboration network, and effects on the generation of knowledge and skills. UK [82]concentrated on several small aspects like impacts on relationships, knowledge and capabilities, turnover or market share. Ireland's impact study [76] was looking for knowledge goals, exploitation goals, network goals and strategic goals. Hungarian case study [27] was a valuable input for us when designing the survey since they experienced FP5 as associated state first time like Turkey experienced FP6. This survey was including three main effects: scientific and technological, economic, and societal. Austria [69] concentrated on five aspects which are: market, network, resources, output and knowledge. Sweden [77] approached the issue a little bit different evaluating impacts on research strategy, structuring research, scale of research, quality and some other elements.

According to EC, three main criteria of successful proposals are its scientific and technological excellence, quality of the consortium and the work plan and its possible economic and societal impact. Both EC approach and previous impact studies include scientific and technological impacts and economic impacts as main indicators of a successful project. We included these two as two of our four impact elements. Since FP6 IST field differs from all other national R&D funding mechanisms in Turkey in the way it supports collaborative R&D projects, it was important for us to assess its impact on participants' sectoral and scientific collaborations and networks as the third impact element. Other institutional impacts of the projects like increase in prestige, new employment positions is considered as the last term of our impact elements.

Likert-type scores were set to assess participants' feelings about the attitude of the impacts they have got from the four main impact types. Each impact type was measures by a set of questions. The weights of the scales were set as: 1-Totally disagree, 2-Disagree, 3-Neither agree nor disagree, 4-Agree, 5-Totally agree. There are also some other types of questions namely multiple choice, and open-ended questions were used in order to have extra information and figures about the impacts.

A. Scientific and Technological Impacts: Definitely most important impacts of a research project are its scientific and technological impacts. Likert-scale questions (Q1) asked participants agreement of the level of their achievements about 12 sub criteria. Those 12 questions are clustered under four main elements of scientific and technological attainments.

- New technological knowhow: new technology acquired from the project both by learning and technology transfer, new or substantially improved research methods and equipment, and gathering new scientific knowledge.
- Business outputs as a consequence of scientific and technological gains: prototypes, software, standards and norms.
- New skills developed: new technical and technological skills, new marketing skills, and new managerial skills.
- Scientific outputs: number of publications, workshops, conferences, patents, IPR rights.

B. Economic impacts: Commercialization of the scientific achievements is one of the most important successes for a research project. Likert-scale questions asked participants' agreement of the level of their achievements about 10 sub criteria. Those 10 questions are clustered under four main elements of economic attainments.

- New and/or improved products, process or services: new products, and dramatic improvements in current products.

- Productivity: Increase of productivity, new or substantially improved production processes.
- Competitive position: access to new domestic or international markets, increase in sales and exports.
- Access to new financial resources: research funding, financial input from the commercialization of the research results.

C. Impacts on collaboration and sector knowledge: FP6 IST R&D projects are all collaborative R&D projects where Turkish partners work with average 10 foreign participants in a project. This unique characteristic of this experience is of attention. Likert-scale questions asked participants agreement of the level of their achievements about nine sub criteria. Those nine questions are clustered under two main elements of impacts of collaboration.

- New knowledge on existing and emerging markets and technologies: monitoring competitors, memberships to European Technology Platforms and other ICT related associations.
- New partnerships: new national and international contacts, deepening current collaborations, sharing risks and costs, setting future partnerships.

D. Other institutional impacts: FP6 IST projects have other noticeable impacts like enhancing capacity, increasing R&D awareness and prestige. We list this type of institutional gains under other institutional impacts tab. Likert-scale questions asked participants agreement of the level of their achievements about 16 sub criteria. Those 16 questions are clustered under five main elements of impacts of collaboration.

- Human resources: training of personal, increase in post-graduate degree personals and job creation.
- Infrastructure development: purchase of equipment, foundation of new R&D laboratories.

- Increased organizational prestige: gaining prestige and visibility.
- Learning EU R&D Programmes: funding opportunities, project proposal preparation, management of international projects.
- Increasing organizational R&D awareness: increase in R&D expenditures, personnel and R&D awareness.

Table 5.5 summarizes the four main impact elements and related survey questions. When we are analyzing correlations, finding scores and comparing means about impact elements, we will mostly base on Likert results.

Table 5.5. Four main impact criteria and respective survey questions

Label	Impact Criteria	Survey question
A	Scientific and technological impacts	Q1: A 1-12 (Likert) Q13,14,15,16,17 (open ended numerical data entry)
B	Economic impacts	Q1: B 1-10 (Likert) Q9,10,11,12 (open ended numerical data entry)
C	Impacts on collaborations and sector knowledge	Q1 – C 1-9 (Likert) Q6,7,8 (Chose one answer type question; yes/no questions) Q18 (Open ended, verbal information entry)
D	Other institutional impacts	Q1 – D 1-16 (Likert) Q5 (Chose one answer type question; yes/no questions) Q19 (open ended numerical data entry)

5.1.2 Additionality

This thesis aims at measuring all types of additionalities acquired by FP6 IST field Turkish participants. Additionality concept has been analyzed in section 2.3. There are three main types of additionalities:

Input additionality is concerned with the additional resources the company invests in R&D when compared with the amount it would normally invest. The question is: What would have Turkish participants would do if they were not funded? This question was embedded into our participant survey (Q4) in order to see input additionality of FP6 IST projects.

Output additionality is the proportion of the output that would not be achieved without public support. This concept usually deals with tangible results that come out of from the research effort. Several open-ended questions were embedded into the survey in order to see output additionality.

Behavioural additionality is the difference in firm behaviour resulting from a research funding. This difference may be in its innovation management, project management, partnerships, and human capital. Several questions in the survey give clues about these gains.

Most of the Likert-scale questions are also associated with additionality. Table 5.6 summarizes the survey questions related with additionalities apart from Likert questions.

Table 5.6. Survey questions for additionalities

Type of additionality	**Survey question**
Input additionality	Q4 (Chose one answer type question)
Output additionality	Q9-17 (open ended numerical data entry)
Behavioural additionality	Q6-7-8 (Chose one answer type question; yes/no questions) Q19 (open ended numerical data entry

5.1.3 Control Factors

This thesis aims at assessing impacts of participation in FP6 IST programme on Turkish organizations. This will be done through answering the questions: who benefits and how? It is important for us to see different effects of different types of participation. EU database gives as valuable information about the participation but some information on participation dynamics is not public and should be asked to the project partner. For example, we know the names and budgets of funded organizations but we do not know the activity they were responsible during the project; it may be research, demonstration or both. Project role is also another important factor which may affect the level of impact; the impact may vary for project coordinators, work package leaders or partners with no leadership. There are some questions inside our survey which intends to clarify implicit facts about participation seen on Table 5.7.

Table 5.7. Survey questions for implicit facts

Implicit fact	Survey question
Project Role	Q2 (multiple choice question)
Project Activity	Q3 (multiple choice question)
Employment and capacity building effects	Q5 (Chose one answer type question; yes/no questions)
National exploitation of new partnerships	Q6 (Chose one answer type question; yes/no questions)
Different types of collaborations	Q7 (Chose one answer type question; yes/no questions)

5.2 Data analysis of participant survey

In this part of the thesis we will interpret survey data using descriptive statistics, crosstabs, find correlations between impacts, and finally we will test our hypotheses.

5.2.1 Level of impacts

1 to 5 Likert-scale questions under question one are analyzed in order to see the perception of the Turkish participants about the impact criteria. Higher share of agreement explains a higher level of achievement in that impact factor.

5.2.1.1 Scientific and technologic impacts:

Figure 5.1 shows participants' ratings of project impact for each of 12 scientific and technological criteria. In order to illustrat better, Likert scores "1-Totally disagree" and "2-Disagree" are combined under "Disagree", "3-neither agree nor disagree" is called as "neutral" finally "4-Agree" and "5-Totally agree" are combined under "Agree".

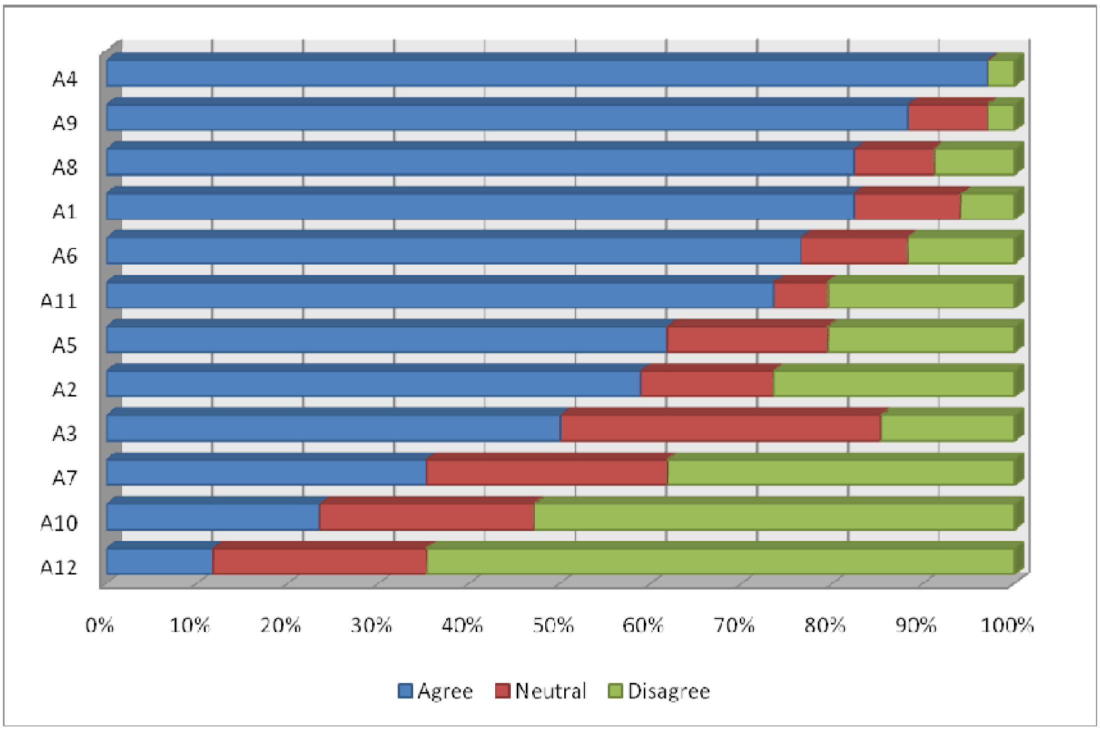

Figure 5.1. In what sense you agree that you achieved below effects and impacts by means of your project involvement?

Figure 5.1 shows that some impact factors like A4, A9, A8 and A1 have higher achievement while some like A10 and A12 have little. Before interpreting these data, we would like to see general ranking calculated from 1-5 scale Likert scores. Table 5.8 summarizes the Likert scores for sub-criteria under scientific and technological impacts factor.

Table 5.8. Ranking for Scientific and Technologic impact factors

	Criteria	***Mean***	***Stdv***
A4	We acquired new scientific knowledge.	4,32	0,64
A9	We acquired new technical and technological skills.	4,12	0,81
A1	We learned new technologies we have not used before.	4,09	0,93
A11	Throughout the project we published academic publications (journal paper, thesis, conference proceedings...).	4,03	1,34
A8	We acquired new administrative skills.	4,00	0,95
A6	We produced a new software.	3,88	1,25
A5	We produced a new prototype.	3,76	1,23
A2	We transferred new technologies we have never used before.	3,56	1,35
A3	We produced or started to use new or substantially improved research methods or equipments we have never used before.	3,53	1,13
A7	We produced a new standard/norm.	2,94	1,18
A10	We acquired new marketing skills.	2,53	1,35
A12	At the end of the project we acquired new intellectual property rights (patent, copyright etc.)	2,29	1,09
	Mean and standard deviation for all factors in average	*3,59*	*1,10*

Findings:

More than 90% of the participants agree that they have acquired new scientific knowledge from the project (A4). It is followed by two similar factors, acquisition of new technical and technological skills (A9) and learning of new technologies not used before (A1). Academic publishing (A11) is listed fourth in Table 5.8 although its agreement percentage is lower than A8 and A6 as seen from Figure 5.1. This is because it has been scored with "5" in Likert scale by academic institutions while it was not agreed with industrial organizations. Significance of this kind of score differences resulting from some factors like organization type or project type will be examined in the following sections. In sum, we can conclude that FP6 IST project participation has positive effects on publication of academic outputs. 80% of the participants agree on that they have acquired new administrative skills (A8), this skill is mostly in area of project management. Almost 75% of participants agree that producing new software (A6) is one of the scientific and technological outputs of the projects. Producing new prototypes (A5) is agreed to be the second important scientific and technological output of the projects with a percentage of 60%, this percentage is %35 for standard and norms. **This situation shows that in FP6 IST projects Turkish participants mostly took part in producing new software, it is followed by producing new prototypes and standard/norms (A7).** 59% of the participants agree that the projects have impact on transferring new knowledge (A2). The projects have considerably less impact on producing and starting to use new research methods and equipments (A3), acquiring new marketing skills (A10) and acquiring new intellectual property rights (A12).

5.2.1.2 Economic impacts:

Figure 5.2 and Table 5.9 show participants' ratings of project impact for each of 10 economic impact criteria.

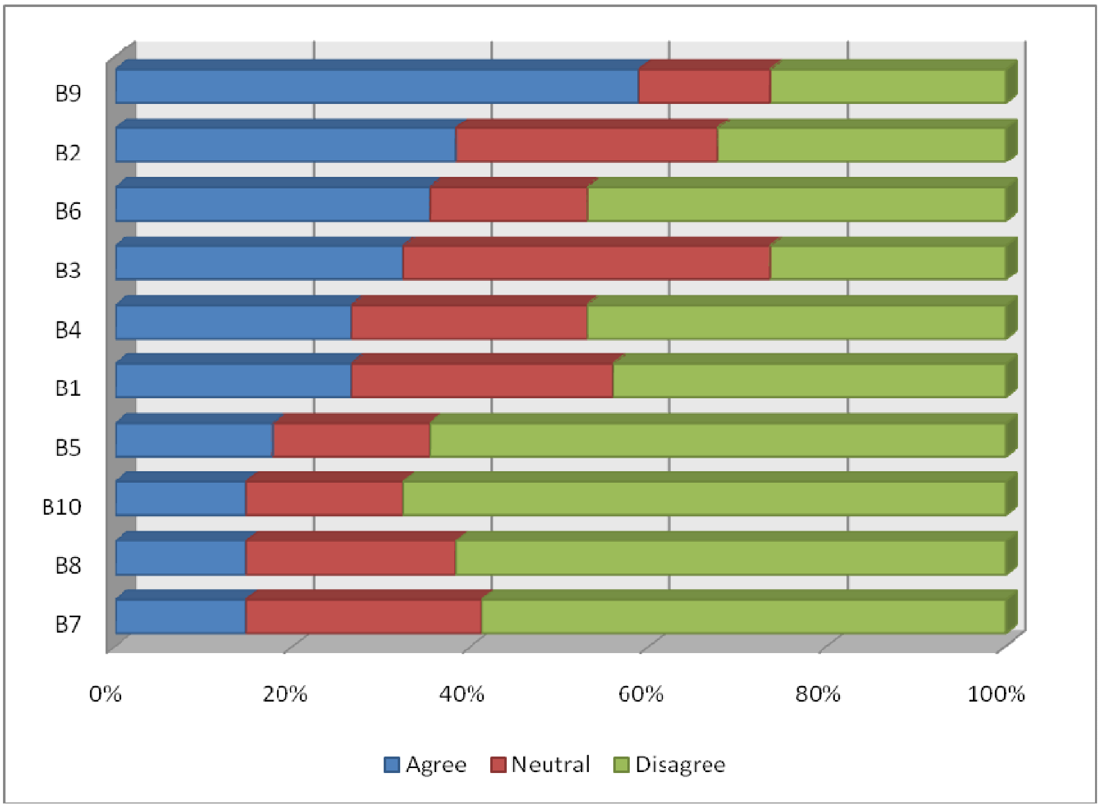

Figure 5.2. In what sense you agree that you achieved below effects and impacts by means of your project involvement?

Table 5.9. Ranking for economic impacts

	Criteria	***Mean***	***Stdv***
B9	We achieved new research funding.	3,62	1,33
B3	Project increased productivity of our organization.	3,15	1,18
B2	We produced more qualitative products.	2,94	1,20
B4	We produced new service or production processes.	2,74	1,33
B6	We reached new international markets.	2,71	1,49
B1	We produced a new product.	2,65	1,15
B5	We reached new domestic markets.	2,32	1,32

Table 5.9 continued

B10	We earned financial income from commercialization of the research results.	2,24	1,37
B7	Project increased our sales.	2,21	1,09
B8	Project increased our export.	2,12	1,12
	Mean and standard deviation for all factors in average	2,67	1,26

Findings:

The mean scores of each criterion and agreement percentages are lower as compared to scientific and technological factors. We can clearly say that the economic impact of project participation is lower. For this reason nearly 60% of the participants agree that projects bring new research funding above all (B9). It is followed by the effects of projects on participants' product qualities (B2), 38% agrees that it has positive impacts on product quality while only 26% agrees that projects have positive impact on producing new products (B1). Projects are also helpful for increasing productivity (B3) of the organization which has the second largest mean score listed in Table 5.9. Apart from producing new or better products, 26% of participants think that project has positive impact on service or production processes (B4). When it comes to its effects on income and market share; the most visible impact is on size of international market (B6), impact on domestic market share is lower (B5). The impact of the projects on sales (B7) and exports (B8) are quite low. Commercialization of research results also bring little (B10) but it is slightly higher when compared with B7 and B8.

5.2.1.3 Impacts on collaborations and sector knowledge:

Figure 5.3 and Table 5.10 show participants' ratings of project impact for each of 9 impacts on collaborations and sector knowledge.

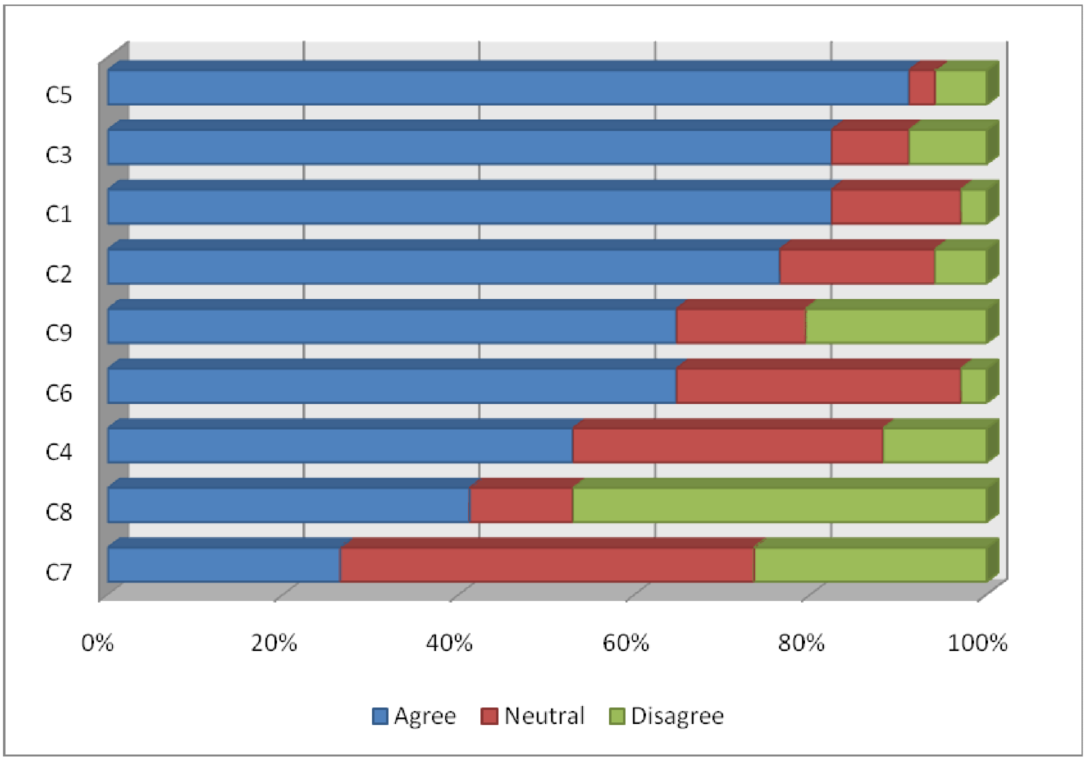

Figure 5.3. In what sense you agree that you achieved below effects and impacts by means of your project involvement?

Table 5.10. Ranking for impacts on collaborations and sector knowledge.

	Criteria	***Mean***	***Stdv***
C5	We achieved new contacts.	4,29	0,91
C1	Project increased our knowledge about the sector.	4,12	0,88
C3	As a result of the project we are following European Technology Platforms and other research networks better.	4,03	1,06
C2	Project increased the number of our sectoral collaborations.	3,91	0,90
C6	Project enhanced our collaboration with the partners we have already been collaborating with.	3,85	0,82
C4	By the help of the project we are monitoring our competitors better.	3,71	1,03
C9	By the help of the project, we set new relationships which will enable us to participate in international R&D programmes like FP and EUREKA	3,53	1,19
C7	Project partnerships decreased the risk of our R&D expenses.	2,94	1,04

Table 5.10 continued

C8	Project increased our participation in national R&D projects like ARDEB, TEYDEB, TTGV etc.	2,85	1,44
	Mean and standard deviation for all factors in average	3,69	1,03

Findings:

When we check the scores in Table 5.10 we can see that the impacts on collaborations and sectoral knowledge are quite high. First of all more than 90% of the participants agree on that project has positive impacts on setting new contacts (C5). Project increases participants' knowledge about the sector they are operating (C1, 80%) and they are following European research networks like European Technology Platforms better (C3, 80%). Projects have also increased the number of participants' sectoral collaboration (C2, 76%) and enhanced the already running research relations (C6, 65%) moreover; this situation is expected to increase further involvement in European projects (C9, 65%). Participants have significant doubts about the impacts of projects on monitoring competitors (C4) and risks of R&D (C7). We can also claim that, involvement in FP6 IST programme does not have a big effect on participating in national R&D programmes (C8).

5.2.1.4. Other institutional impacts

Figure 5.4 and Table 5.11 show participants' ratings of project impact for each of 16 other institutional impacts.

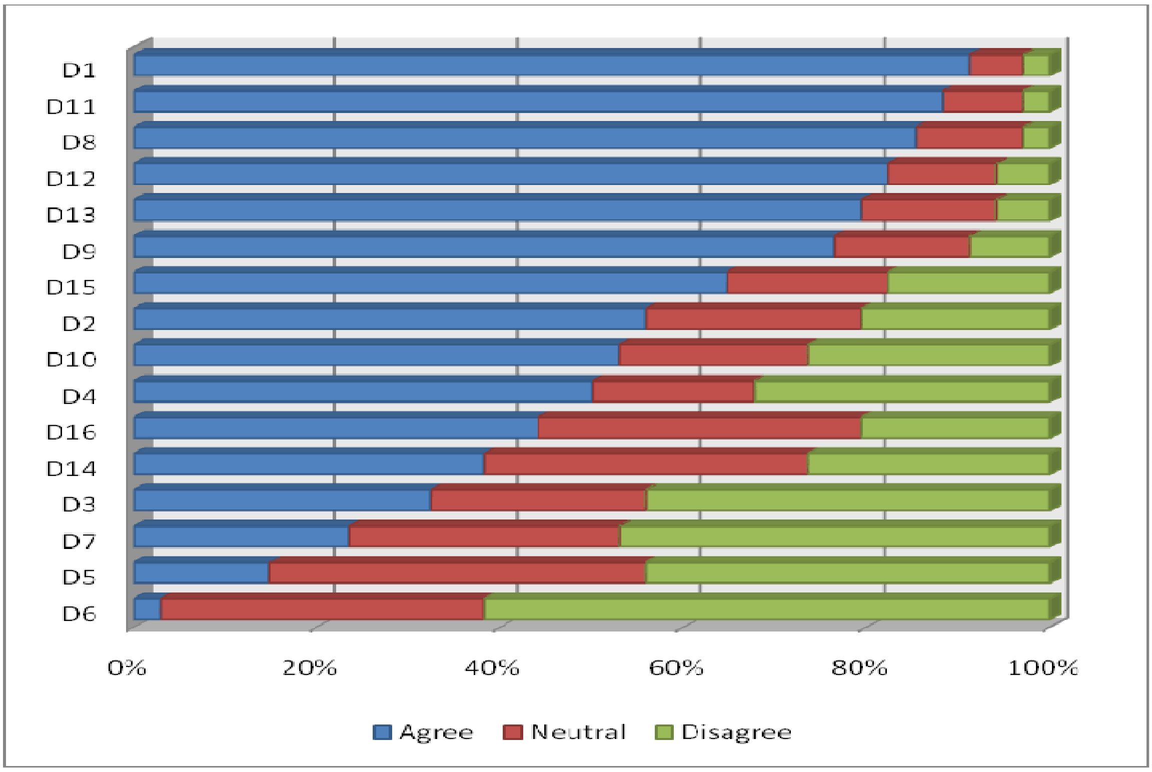

Figure 5.4. In what sense you agree that you achieved below effects and impacts by means of your project involvement?

Table 5.11: Ranking for other institutional impacts.

	Criteria	***Mean***	***Stdv***
D1	Project personnel acquired new knowledge and skills.	4,29	0,84
D11	We had new skills in international project proposal preparation.	4,21	0,84
D12	Our organization gained prestige.	4,21	0,98
D8	We have been informed about the research funding opportunities in EU.	4,18	0,87
D13	Our organization's recognition in foreign research networks has increased.	4,18	1,00
D9	We achieve new knowledge and experience on managing international R&D projects.	4,00	1,02
D15	R&D awareness in our organization has increased.	3,65	1,23
D2	Number of post graduate degree personals in our organization has increased.	3,50	1,16
D10	We had new skills in national project proposal preparation.	3,44	1,31
D16	Project increased the number of our R&D personal.	3,29	1,14

Table 5.11 continued

D4	New researcher employment positions were opened.	3,24	1,30
D14	Project increased our total R&D spending.	3,18	1,24
D3	New management positions were opened.	2,94	1,23
D7	We set a new research laboratory.	2,74	1,21
D5	New support service positions were opened.	2,50	0,99
D6	We set a new test and measurement laboratory.	2,12	0,88
	Mean and standard deviation for all factors in average	3,48	1,08

Findings:

Again we can notice that the scores are quite high. The average is almost 3.5. However, the variation between the agreement ratios differentiates highly for this criterion. More than 90% of the participants agree on that project enhances personals' skills and knowledge (D1). Participation has positive impact on international project proposal preparation (D11, 88%), being informed about funding opportunities in EU (D8, 85%), experience in managing international R&D projects (D9, 76%). Participation also increases their prestige (D12, 82%) and recognition in foreign research networks (D13, 79%). It is also agreed upon that the projects increases organizations' R&D awareness (D15, 65%). Although project involvement is meant to increase post-graduate degree positions (D2, 56%), the same effect is far below in researcher (D4), management (D3) and support service positions (D5). In any case, there is an impact on the number of R&D personals (D16, 35%). We cannot see the same positive effect on national project preparation (D10) when compared with D11, as expected. Projects have considerably low impact on total R&D spending (D14) and setting a new laboratory (D6,D7).

5.2.1.5. Impacts in total

Above we have listed our findings about the four main impact criteria we are dealing with. Now, we will put all together to see the big picture. We would like to answer the following questions:

- What is the most recognizable impact from four main impact criteria?
- What is the general ranking of all 47 sub criteria

Table 5.12 shows the average total scores for the Likert-scale questions with respect to four main criteria.

Table 5.12. Total scores for main factors.

Label	**Impact Criteria**	**Score**
A	Scientific and technological impacts	3,59
B	Economic impacts	2,67
C	Impacts on collaborations and sector knowledge	3,69
D	Other institutional impacts	3,48

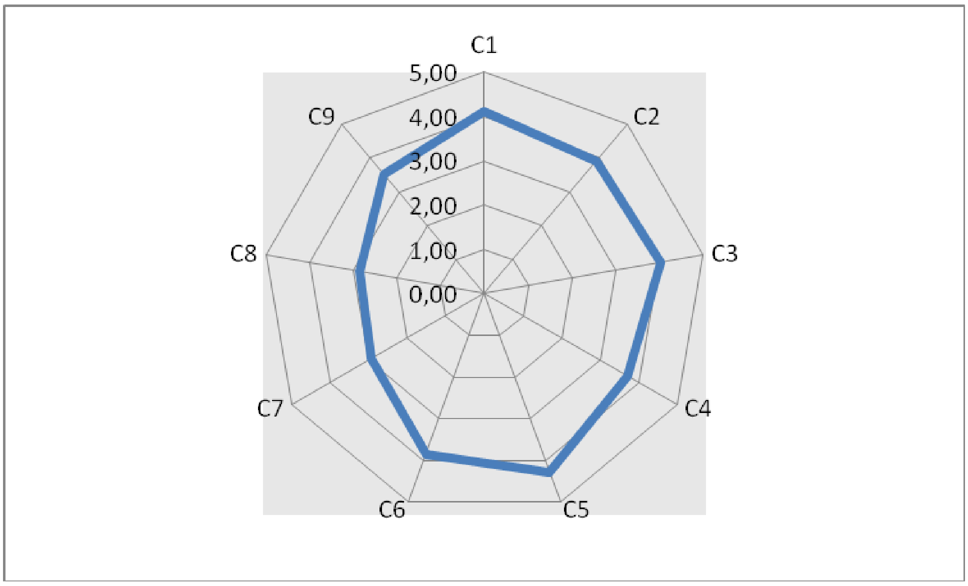

Figure 5.5. Radar chart for impacts on collaborations and sector knowledge

FP6 IST field has the biggest impact on collaborations and sector knowledge as evident from Figure 5.5. This situation suggests the potential knowledge spillovers from project partners to Turkish research area. This effect will depend on how Turkish innovation system absorbs and transfers useful international knowledge. Participants indicated that they have achieved new contacts and enhanced their collaborations with current contacts. They have started to take part in European research networks like European Technology Platforms which also increased their sectoral cooperation and somehow they got new contacts for further projects. The impact of the programme on sharing risks is not clear and its impact on national collaborations is substantially lower.

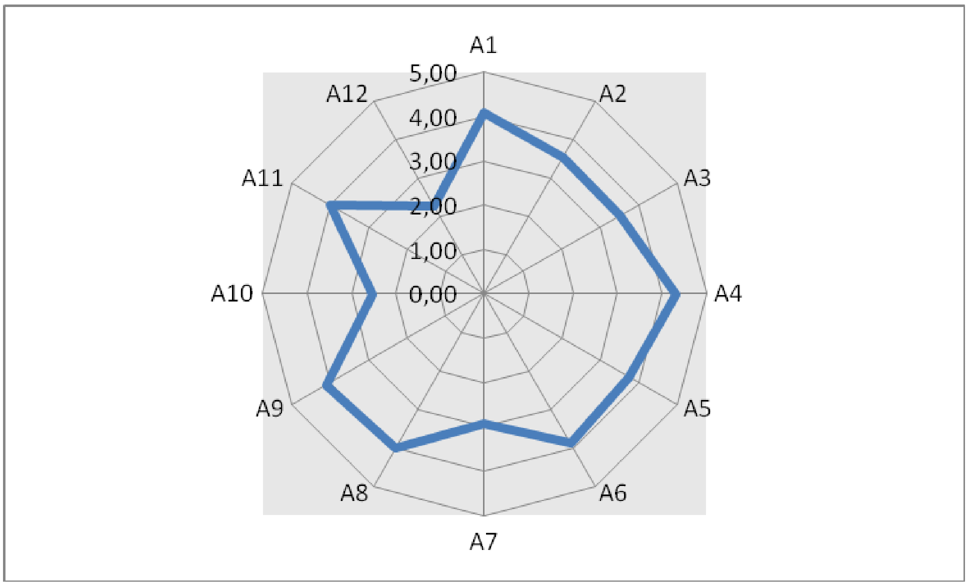

Figure 5.6. Radar chart for scientific and technological impacts

Second highest impact has been felt in scientific and technological factors (Figure 5.6). FP funds generate 5% of all money spent on EU. The idea behind the programme is to fund excellent research. The low success rates indicate that only the very best projects are able to be funded. To this end it was expected for Turkish partners to have high impacts in this factor. The highest impact is seen as increase of new scientific knowledge, technical and technological skills; learning or transfer of new technologies. This brought high number of publications especially for academic participants. Project management skills of the participants have increased by the project, but the same effect is not valid for their marketing skills. Projects have high impact in producing new software, and prototypes while they lack behind in producing standard and norms. The lowest impact is in producing new intellectual property rights; the impact is low in this direction.

Achieving high impacts in the above impact factors is common for impact studies. Hungarian study [27] expresses that international partnerships and increase in prestige were two most significant impacts. Irish study [76] reports that, achievements are greatest in terms of enhancing the knowledge base of participants. Finnish study [74] confirms that the two most important reasons for FP participation are access to new knowledge and networking. German impact assessment [75] reveals that the programme is beneficial in increasing the knowledge base and better cooperates with EU firms. Again in UK [82] it is noted that the impact is highest in knowledge and networking.

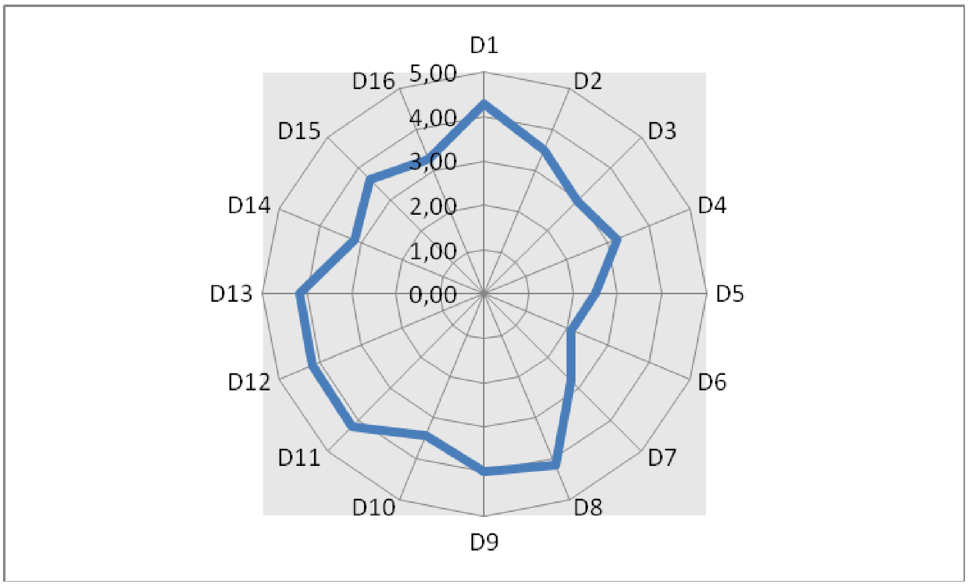

Figure 5.7. Radar chart for other institutional impacts.

Other institutional impacts come third, and level of impacts is illustrated in Figure 5.7. Project personal earns new knowledge and skills by the help of the project. Projects have positive impacts on R&D human capital. One important impact is on proposal preparation and being informed about EU research funding. The programme has high impact on participants' prestige and recognition in international research networks, while the impact on research capacities like setting new R&D laboratories is considerably low.

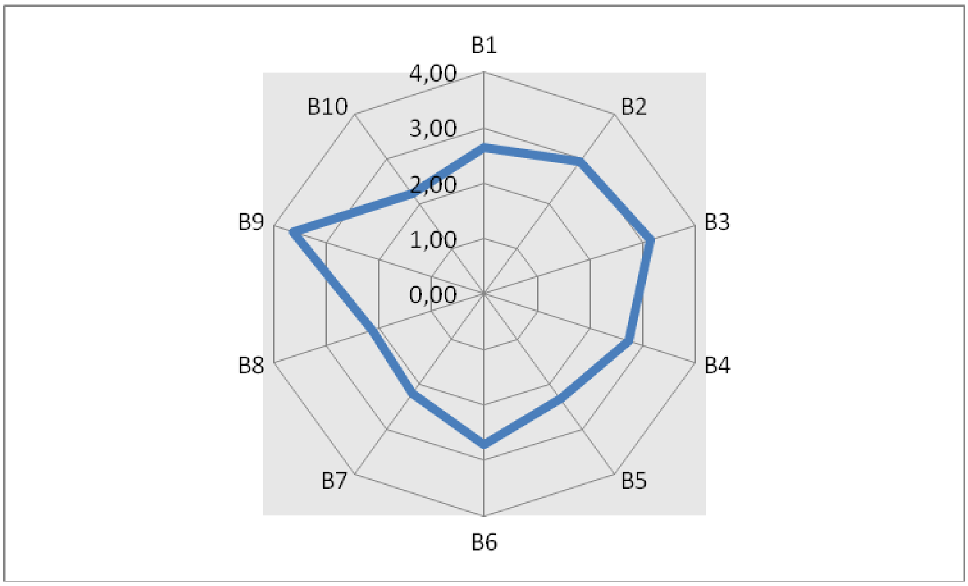

Figure 5.8. Radar chart for economic impacts.

It can be concluded that projects have high impact on all criteria except for economic impacts. Economic impacts are lower than the others as can be seen on Figure 5.8. Achieving new research funding, increase in productivity, producing better products are three positive impacts of the projects. Impact on sales, export and financial gains from commercialization of the research results is low. This situation should not be interpreted that FP6 IST projects do not have any economic impacts, this situation was expected since FP6 IST projects have finished a few years ago in which it is not reasonable to wait concrete economic results. Moreover, it is not easy to assess and/or measure the economic impacts by participants.

We can see similar results in other national impact studies. In Austrian impact study[69], it is confirmed that, "hard" economic effects (e.g. development of new markets, increased sales) are only expected in the long run. In German impact study[75], it is concluded that the economic impacts of the programme are rather small. Ireland indicates that, few participants have experienced significant financial returns, however they expect more in the future[76].

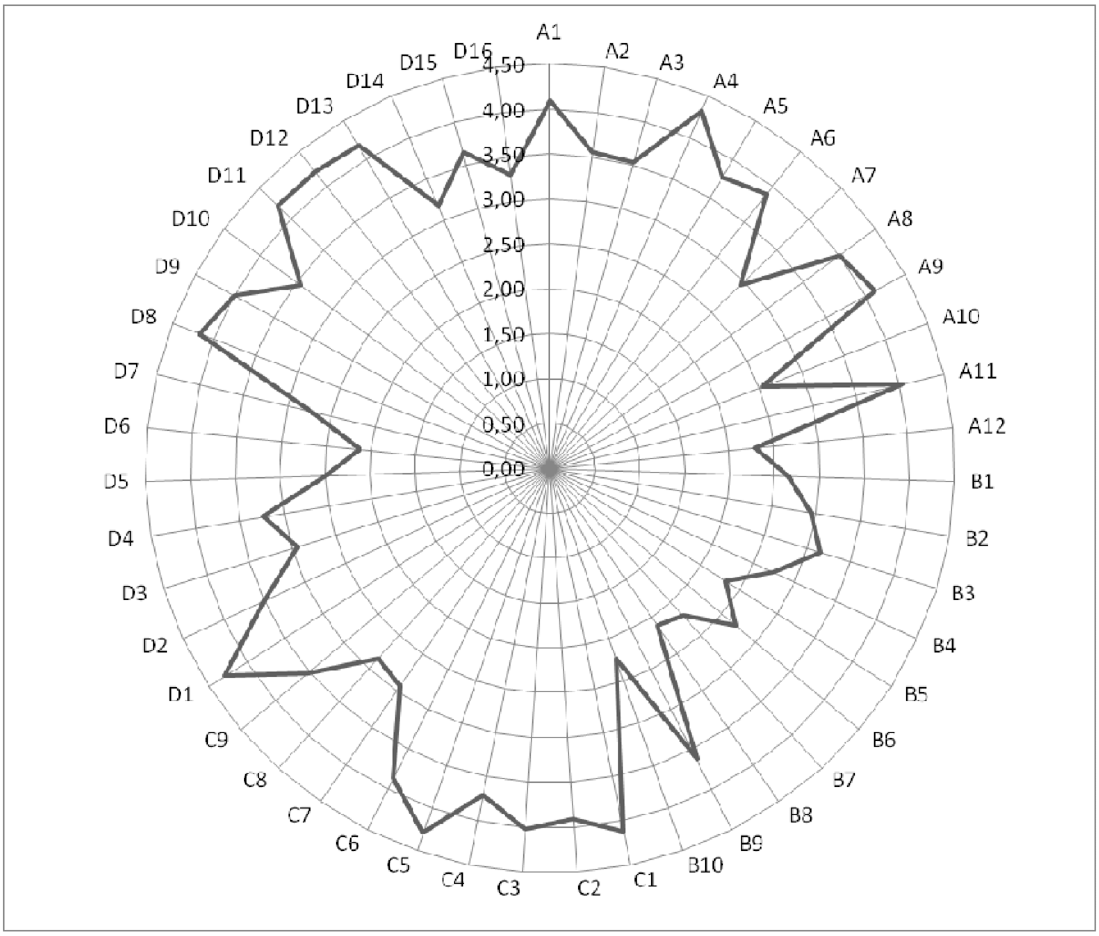

Figure 5.9 Radar chart for all impacts.

Figure 5.9 shows that impacts on economic factors are lower when compared with other factors. Limited number of impact criterion has average score under 3.00, most of which are economic impact factors. Scientific and technological impact factors tend to be high except A7, A10 and A12. It seems that, the projects are not as effective in enhancing marketing skills, producing new standards and norms and acquiring new intellectual property rights as it is in other factors. Impacts on collaborations and sectoral knowledge are quite high. In this factor C8 has the lowest score confirming that FP6 IST participation did not stimulate participation in national programmes. It is clear that participants had positive institutional gains from the project. However, the projects are not good at opening new management and support service positions (D3, D5) while it is better in opening new researcher employment positions and enhancing personnel's' knowledge and skills (D1, D4, D16). The impact on infrastructure development is also low; participants were not able to set new research or measurement laboratories.

5.2.2. Correlations between impacts

Data is analyzed by using Statistical Package for the Social Sciences (SPSS) 17.0. Kendall's Tau-b correlation coefficients were calculated between sub-question pairs.

5.2.2.1 Correlations between scientific and technological impacts

Correlations between 12 scientific and technological factors can be seen in Appendix C. Correlation coefficients greater than or equal to 0.6 were evaluated as meaningful[11]. Significant correlation coefficients and related interpretations are shown in Table 5.13.

[11] Since it is not proper to use the square of the Kendall's Tau-b correlation coefficient, values of correlation coefficients are interpreted.

Table 5.13 Significant correlations between scientific and technological impact factors

Kendall's tau_b	A1	A3	A4	A6	A9
A1	1,00	0,48	0,51	0,55	0,64
A3	0,48	1,00	0,61	0,68	0,59
A4	0,51	0,61	1,00	0,66	0,69
A6	0,55	0,68	0,66	1,00	0,70
A9	0,64	0,59	0,69	0,70	1,00

Those correlations can be interpreted as follows:

A1-A9: This relation is obvious, learning new technologies bring new technical and technological skills.

A3-A4: Producing or starting to use new or substantially improved research methods or equipments is related with acquiring new scientific knowledge. We can say that new research methods and equipments enhance knowledge acquisition.

A3-A6: Producing or starting to use new or substantially improved research methods or equipments is related with producing new software. Improvement in research methods and equipment ends with tangible research outputs like new software.

A4-A6: Acquiring scientific knowledge is related with producing new software. We can say that in FP6 IST projects knowledge has been transformed in software.

A4-A9: The ones acquiring scientific knowledge also acquire new technical and technological skills. Or they transform knowledge in skills.

A6-A9: Acquiring new technical and technological skills is related with producing new software. **This concludes that, acquired knowledge and skills were mostly transferred into software development in the projects**.

5.2.2.2 Correlations between economic impacts

Correlations between 10 economic factors can be seen in Appendix C. For those factors correlations are quite high. Correlation coefficients greater than or equal to

0.7 were evaluated as meaningful. Significant correlation coefficients and related interpretations are shown in Table 5.14.

Table 5.14 Significant correlations between economic impact factors

Kendall's tau_b	B1	B2	B4	B5	B6	B7	B8	B10
B1	1,00	0,73	0,64	0,65	0,64	0,73	0,66	0,74
B2	0,73	1,00	0,63	0,54	0,57	0,67	0,63	0,61
B4	0,64	0,63	1,00	0,62	0,63	0,75	0,71	0,66
B5	0,65	0,54	0,62	1,00	0,77	0,79	0,76	0,79
B6	0,64	0,57	0,63	0,77	1,00	0,84	0,79	0,63
B7	0,73	0,67	0,75	0,79	0,84	1,00	0,89	0,77
B8	0,66	0,63	0,71	0,76	0,79	0,89	1,00	0,81
B10	0,74	0,61	0,66	0,79	0,63	0,77	0,81	1,00

Those correlations can be interpreted as follows:

B1-B2: Producing new products and producing high quality products are related. This is an obvious relation.

B1-B7: Producing new product and increase in sales are related. We can see that new products have increased participants' sales.

B1-B10: Producing new products is related with earning income from commercialization of research results. This is a similar finding as B1-B17.

B4-B7: Producing new service and production processes is related with increase in sales. Productivity growth brought participants financial gains.

B4-B8: Producing new service and production processes is related with increase in export. The improvements are felt in export figures for the ones who were able to increase their productivity.

B5-B6: Increasing access to international market is related with increasing domestic market share. Financial benefits of the project results are affecting **both domestic and international success**.

Correlations between B5, B6, B7, B8, and B10: **Once the project results are commercialized, this situation brings positive effects on both sales in domestic and world markets.**

5.2.2.3 Correlations between impacts on collaborations and sectoral knowledge

Correlations between 9 collaboration and sectoral knowledge factors can be seen in Appendix C. Correlation coefficients greater than or equal to 0.6 were evaluated as meaningful. Significant correlation coefficients and related interpretations are shown in Table 5.15.

Table 5.15. Significant correlations between impacts on collaborations and sectoral knowledge

Kendall's tau_b	C3	C4	C5	C9
C3	1,00	0,62	0,63	0,61
C4	0,62	1,00	0,60	0,38
C5	0,63	0,60	1,00	0,64
C9	0,61	0,38	0,64	1,00

Those correlations can be interpreted as follows:

C3-C4: Following European research networks is related with better monitoring the competitors. We can conclude that, organizations operating in similar sectors also follow similar research networks.

C3-C5: Following European research networks is related with achieving new contacts. This shows that, being in research networks are good for setting new connections.

C3-C9: Following European research networks is related with setting new relationships for future participation in EU research projects. This shows that,

following research networks have leverage effect in winning R&D funding from EU programmes.
C5-C9: Obvious relation, new contacts are eager to be used as project partnerships for future EU research proposals.

5.2.2.4 Correlations between other institutional impacts

Correlations between 16 institutional impact factors can be seen in Appendix C. Correlation coefficients greater than or equal to 0.6 were evaluated as meaningful. Significant correlation coefficients and related interpretations are shown in Table 5.16.

Table 5.16. Significant correlations between other institutional impacts

Kendall's tau_b	D1	D3	D4	D8	D9	D11	D12	D13	D14	D16
D1	1,00	0,51	0,31	0,62	0,59	0,49	0,58	0,53	0,22	0,24
D2	0,26	0,30	0,58	0,39	0,44	0,30	0,37	0,38	0,45	0,60
D3	0,51	1,00	0,61	0,32	0,33	0,42	0,40	0,36	0,24	0,38
D4	0,31	0,61	1,00	0,36	0,42	0,35	0,33	0,31	0,37	0,59
D8	0,62	0,32	0,36	1,00	0,65	0,63	0,58	0,54	0,34	0,39
D9	0,59	0,33	0,42	0,65	1,00	0,67	0,56	0,52	0,37	0,36
D11	0,49	0,42	0,35	0,63	0,67	1,00	0,65	0,60	0,36	0,44
D12	0,58	0,40	0,33	0,58	0,56	0,65	1,00	0,98	0,20	0,33
D13	0,53	0,36	0,31	0,54	0,52	0,60	0,98	1,00	0,16	0,33
D14	0,22	0,24	0,37	0,34	0,37	0,36	0,20	0,16	1,00	0,64
D16	0,24	0,38	0,59	0,39	0,36	0,44	0,33	0,33	0,64	1,00

Those correlations can be interpreted as follows:
D1-D8: One of the most important skills acquired seems to be being informed about funding opportunities in EU.
D3-D4: Opening of new research and management positions are related. Research and management positions are parallel.

D8-D9-D11: The ones who learned about EU funding opportunities also achieved new knowledge and experience about preparing and managing international research projects.

D11-D12: Having new skills in international project proposal preparation is related with gaining prestige. When partners have enough experience to write and lead proposals, they get in contact with more people and this increases their prestige.

D12-D13: Gaining prestige is related with recognition in foreign research networks. We can say that projects both increase participants' prestige in Turkey and abroad.

D14-D16: Once project increases R&D spending it also increases R&D personnel. This is an obvious relation.

5.2.2.5. Correlations between all factors

Correlations between all 47 factors can be seen in Appendix C. We took the highest correlations two-by-two (A-B, A-C, A-D, B-C, C-D, B-D) between four main impact factors. Below Table 5.17 shows the highest correlations between groups.

Table 5.17. Most significant correlations between all 47 factors

Kendall's tau_b	B4	B7	C3	C4	C5	D1	D10	D12	D13
A4			0,69					0,77	0,765
A9				0,68		0,72	0,72		
A10	0,72	0,72							
B4							0,59		
B9					0,68				
D9					0,63				
D13			0,65						

Those correlations can be interpreted as follows:

A4-C3: There is a high relation between following European research networks and acquiring new knowledge. This shows importance of networking for knowledge acquisition.

A4-D12: Acquiring new knowledge is related with increase in prestige. The most successful organizations gain prestige by the help of the knowledge they absorbed from the projects.

A4-D13: Organization's recognition in foreign research networks is related with acquiring new knowledge. Above situation and this relation is related with absorptive capacities of the organizations. Once the partner is skilled enough to acquire working knowledge, they are widely accepted in international research networks, they gain prestige and they are recognized well.

A9-C4: Acquiring new technical and technological skills is related with monitoring competitors better. Acquiring new skills is an indicator of success and being in right consortiums and following right technologies. As a consequence those partners are also successful in monitoring their competitors.

A9-D1: Acquiring new technical and technological skills is related with achieving new contacts. We can conclude that, the more the partners network the more successful in scientific and technological terms they are.

A9-D10: Acquiring new technical and technological skills is related with new skills in preparing national projects. We can say that, that knowledge they got positively affect their national projects. The skills coming from EU projects are so qualified that, they are easily accepted as national projects.

A10-(B4, B7): The ones who acquired new marketing skills were able to reflect this competence in their sales and business processes.

B4-D10: Producing new service or production processes is related with having new skills in national project proposal preparation.

B9-C5: Having new research contact brings new research funding.

D9-C5: Having new research contacts is related with achieving new knowledge and experience on managing international projects. As the contacts increases, participants start to lead proposals.

D13-C3: Organization's recognition increases as it is being represented in research networks. This is a similar finding like in Finland's impact study: collaborations bring networking and facilitates prestige[73].

5.2.3. Comparing impacts with respect to participant profiles: who benefits and how?

So far we have analyzed the general feelings of the participants about the impact factors of the projects. Although this approach gives us valuable information about the aggregate impacts, it is crucial to know impacts of participation for different control factors. The 34 survey participants include researchers both from academia and industry, there were different project types like IP, STREP as well as NoEs, they had different roles in projects; some of them were having important roles like to coordinate the projects while some did not have any leadership. Some participants were doing just research, some were taking part in demonstration activities, some were doing both. We think that, above mentioned factors affects the level of impact the participants gain from the projects. For this reason we have set a list of hypothesis about the effects of those control factors and we tested them. Table 5.18 illustrates the list of our hypothesis.

Table 5.18 List of hypothesis

Hypothesis	Control Factor
1. Partners taking part in IP and STREP projects have **higher** scientific and technological impacts than partners taking part in NoE projects.	Project Instrument
2. Partners taking part in IP and STREP projects have **higher** economic impacts than partners taking part in NoE projects.	Project Instrument
3. Partners taking part in IP and STREP projects have **lower** impacts on collaborations and sector knowledge than partners taking part in NoE projects.	Project Instrument
4. Partners taking part in IP and STREP projects have **higher** institutional impacts than partners taking part in NoE projects.	Project Instrument
5. Research organizations have **higher** scientific and technological impact than industrial/business organizations.	Organization Type
6. Research organizations have **lower** economic impact than industrial/business organizations.	Organization Type
7. Research organizations have **higher** impacts in collaborations and sectoral knowledge than industrial/business organizations.	Organization Type
8. Research organizations have **higher** institutional impacts than industrial/business organizations.	Organization Type
9. Partners conducting research activities have **higher** impacts in all four factors than the partners who only take part in demonstration activities.	Project Activity
10. Partners who take part in both research and demonstration activities in the project has **higher** impacts in all factors than partners who only take part in research activities.	Project Activity
11. Partners who were coordinator or WP leader have **higher** impacts in all factors than the partners who were task leader or partners with no leadership.	Project Role
12. Partners employing TUBITAK scholar holder have **higher** impacts in all impact factors.	TÜBİTAK Scholar
13. Partners who purchased equipments have **higher** impacts in all factors.	Purchasing Equipment
14. Partners who set new R&D departments have **higher** impacts in all factors.	Setting R&D department
15. Partners who set partnerships beyond EU (e.g. with South Korea, U.S., Canada ...) have **higher** impacts in all factors.	Partnership beyond EU
16. Partners who set national partnerships have **higher** impacts in all factors.	National Partnership
17. Partners who submitted new projects have **highe**r impacts in collaborations and advance in sectoral knowledge.	New Project
18. Partners who received higher research grants have **higher** impacts in all factors.	Received grant

Following analyses were made using Statistical Package for the Social Sciences (SPSS) 17.0. In order to see if there is a significant difference between impacts for different control groups, we test the null hypothesis that the levels of impacts are same for control factors. Since we were not able to assume normality for the data, we were not able to use parametric methods like independent-samples T test. Instead of it, we used the non-parametric testing method Mann-Whitney U test which is an alternative test for T test for testing two independent samples. We tested all 47 impact factors for each control factors.

We are occupying Mann-Whitney U test to test the null hypothesis H_0 and its alternative H_a are defined below.

H_o: There is no significant difference between sample1 and sample2 defined by control factors.

H_a: There is significant difference between sample1 and sample2 defined by control factors.

For the reliability of the estimates, 95% confidence interval is accepted to be significant enough.

Hypotheses were testes with below findings:

- **Hypothesis 1,2 and 4**

In hypothesis 1,2,3 and 4 we are attempting to see the effects of project instruments on impact. Out of 34 survey participants 15 are taking part in STREP projects, six are taking part in IP projects and 13 are partners of NoE projects.

Table 5.19 Hypothesis 1,2 and 4

	Impact Factor	Project Instrument		Asymp. Sig	
		IP or STREP	NoE	p value	Level
		Median1	Median2		
A1	We learned new technologies we have not used before.	5,00	4,00	0,03	*
A7	We produced a new standard/norm.	3,00	2,00	0,03	*
B2	We produced more qualitative products.	4,00	2,00	0,01	*
B4	We produced new service or production processes.	3,00	2,00	0,03	*
B6	We reached new international markets.	3,00	1,00	0,03	*
B7	Project increased our sales.	3,00	1,00	0,03	*
B8	Project increased our export.	2,00	1,00	0,04	*
D11	We had new skills in international project proposal preparation.	5,00	4,00	0,01	*
*	Significant at 5% level, Mann-Whitney U Test				
**	Significant at 1% level, Mann-Whitney U Test				

The impact factors for which Mann-Whitney U test rejects null hypothesis H_0 as listed in Table 5.19.

We can see that participants in IP and STREP projects have significantly higher scientific and technological impacts in A1 and A7. Those projects are more useful in learning new technologies and producing standard and norms. There is no significant difference for remaining 10 scientific and technological factors.

The difference is higher for economic impact factors. **Five of 10 economic impacts are higher for the IP and STREP participants.** This is what we have been expecting since NoE projects are not aiming at a core research on a technological issue but bringing together key actors for deeper collaboration.

The difference is significant only one of the 16 institutional impact criteria. Since NoE projects include more partners compared with IP and STREP projects, participants usually are less active in proposal preparation phase, this makes A11 significantly higher for IP and STREP projects. **We can also say that, project instrument does not have an immense effect on institutional impacts.**

- **Hypothesis 3**

In hypothesis 3 we claimed that NoE participants have higher impacts on collaborations and sectoral knowledge when compared with IP and STREP projects. In fact, as defined by EC, the main aim of NoE projects is lowering barriers between hitherto split communities and disciplines and advance knowledge in the field. However, our finding does not support this idea, moreover it seems that IP and STREP projects may be rather more successful in impacts on collaborations and sectoral knowledge for Turkish participants. As seen from Table 5.20 the only significant difference is detected in C8, and in this impact factor, IP and STREP projects are more successful. We can say that, NoE projects have little impact on participating national research programmes.

Table 5.20 Hypothesis 3

	Impact Factor	**Project Instrument**		**Asymp. Sig**	
		IP or STREP	**NoE**	**p value**	**Level**
		Median1	**Median2**		
C8	**Project increased our participation in national R&D projects like ARDEB, TEYDEB, TTGV etc.**	4,00	2,00	0,02	*

This situation shows that NoE projects were not as successful as planned for Turkish participants. Conversely, the networks set in FP6 IST may be immature or they might be at the early stages before being a centre of excellence. In any case in FP7 ICT field the number of NoE projects supported by EC is significantly lower than those in FP6 IST.

- **Hypothesis 5,7 and 8**

In hypotheses 5, 7, 6 and 8 we would like to test the impacts of participation on different organization types. 21 of the survey participants are from Universities, one is from a research centre, 11 of them are SMEs and there is only one big industrial organization. We have grouped universities and research centres under one category and called it "Academia" and we have collected SMEs and big industrial organizations to another group and called it as "Industry and Business". Table 5.22 and Table 5.21 illustrate the main impacts for which these two groups have significant differences.

Table 5.21 Hypothesis 5, 7 and 8

	Impact Factor	**Organization Type**		**Asymp. Sig**	
		Academia	**Industry and Business**	**p value**	**Level**
		Median1	**Median2**		
A11	Throughout the project we published academic publications (journal paper, thesis, conference proceedings...).	5,00	2,00	0,00	**
C2	Project increased the number of our sectoral collaborations.	4,00	4,00	0,04	*
C5	We achieved new contacts.	5,00	4,00	0,01	**
D2	Number of post graduate degree personals in our organization has increased.	4,00	3,00	0,01	**

Table 5.21 continued

D4	New researcher employment positions were opened.	4,00	2,00	0,01	**
D7	We set a new research laboratory.	3,00	2,00	0,02	*
D9	We achieved new knowledge and experience on managing international R&D projects.	4,00	3,50	0,04	*
*	**Significant at 5% level, Mann-Whitney U Test**				
**	**Significant at 1% level, Mann-Whitney U Test**				

We can see that there is no significant difference between the scientific and technological impacts for academia and industry/business organizations. The difference is only significant for A11, and which is an impact factor mostly in scope of academic organizations.

Considering impacts on collaborations and sectoral knowledge, we can conclude that **academic institutions are more successful in building collaborations and setting new contacts**. Achievement of C2 and C5 are significantly higher for academia, in addition it is also worthy to indicate that, for C5 the significance is at 1% level.

Four out of 16 institutional impact factors are significantly higher for academia. D2 and D4 show that academia **is using projects better in enhancing its research human resources**, with a 1% significance level. D7 shows that **academia used projects to strengthen their research infrastructures** via setting new research laboratories and they have acquired significantly more management skills.

The little difference in scientific and technological factor and significant difference for D2 and D4 are also valid for Austria. While all types of organizations name increased scientific and technological impacts, universities were able to achieve short term employment impacts according to Austria study[69].

When we look at overall figures for hypothesises 5, 7 and 8 we can say that **academia got higher impacts from FP6 IST projects than industry/business organizations**.

- **Hypothesis 6**

Different from Hypothesises 5, 7 and 8; we think that industry/business organizations have higher economic impacts from FP6 IST projects. This is because while these organizations are looking for financial benefits, academia is more concentrated on scientific and technological excellence.

Test results show that, industry/business organizations did not get much bigger economic impact from the projects or it has not been long enough to realize those gains. **For the time being, the economic impacts of participation are not far different for different organization types.** Difference in B2 and B9 are significant while B2 is a special benefit for industry/business and B9 is more important for universities.

Table 5.22 Hypothesis 6

	Impact Factor	**Organization Type**		**Asymp. Sig**	
		Academia	**Industry and Business**	**p value**	**Level**
		Median1	**Median2**		
B2	We produced more qualitative products.	3,00	4,00	0,04	*
B9	We achieved new research funding.	4,00	2,00	0,00	**
*	**Significant at 5% level, Mann-Whitney U Test**				
**	**Significant at 1% level, Mann-Whitney U Test**				

- **Hypothesis 9**

There are three main activity funded under FP6 projects. **Research and technological development activities** directly aim at creating new knowledge, new technology, and products[87]. **Demonstration activities** prove the viability of new technologies that offer a potential economic advantage, but which cannot be commercialized directly (e.g. testing of products such as prototypes)[87]. The third activities are the coordination activities not covered by these two.

Out of 34 survey participants, 17 organizations took part only in research activities, two took part only in demonstration activities and 15 did both of them. The funding rates for these activities are also different. 75% of research activities are funded by EC while this ratio is 50% for demonstration activities, **which makes it less favourable to take part in demonstration activities.** Since we think that research activities are more valuable in projects, in hypothesis 9 we tested the difference in achievements between the participants who do research and with the ones who does only demonstration.

As seen on Table 5.23 the ones who does research had significantly more impact in 13 out of 47 impact factors. Since there were only two organizations who did only demonstration it is not possible to make concrete comments about this topic. However, we can conclude that the difference is significant for three of the main impact criteria except for economic impacts.

Table 5.23 Hypothesis 9

	Impact Factor	Project Activity		Asymp. Sig	
		Research	Demonstration	p value	Level
		Median1	Median2		
A1	We learned new technologies we have not used before.	4,00	2,00	0,02	*
A3	We produced or started to use new or substantially improved research methods or equipments we have never used before.	3,0000	1,5000	0,02	*
A8	We acquired new administrative skills.	4,00	2,00	0,02	*
A11	Throughout the project we published academic publications (journal paper, thesis, conference proceedings...).	4,00	1,00	0,01	**
B9	We achieved new research funding.	4,00	1,50	0,04	*
C2	Project increased the number of our sectoral collaborations.	4,00	2,00	0,02	*
C3	As a result of the project we are following European Technology Platforms and other research networks better.	4,00	1,00	0,01	*
C5	We achieved new contacts.	4,00	1,50	0,01	**
D9	We achieved new knowledge and experience on managing international R&D projects.	4,00	2,00	0,03	*
D11	We had new skills in international project proposal preparation.	4,00	2,00	0,01	*
D12	Our organization gained prestige.	4,00	1,50	0,01	*
D13	Our organization's recognition in foreign research networks has increased.	4,00	1,50	0,01	*
D15	R&D awareness in our organization has increased.	4,00	1,50	0,03	*
*	**Significant at 5% level, Mann-Whitney U Test**				
**	**Significant at 1% level, Mann-Whitney U Test**				

- **Hypothesis 10**

As we have mentioned above, partners may favour to take part in research activities instead of demonstration activities because of the funding rates. The organization is subject to pay more for the project from its own financial resources as it takes part in demonstration activities. Here we want to test the difference between partners who just do research and the partners who do both.

Table 5.24 Hypothesis 10

	Impact Factor	Project Activity		Asymp. Sig	
		Only Research	Both	p value	Level
		Median1	Median2		
A2	We transferred new technologies we have never used before.	3,00	5,00	0,02	*
A5	We produced a new prototype.	3,00	5,00	0,01	*
A9	We acquired new technical and technological skills.	4,00	4,00	0,03	*
A10	We acquired new marketing skills.	2,00	4,00	0,02	*
A11	Throughout the project we published academic publications (journal paper, thesis, conference proceedings...).	4,00	5,00	0,02	*
B10	We earned financial income from commercialization of the research results.	1,00	2,00	0,02	*
C1	Project increased our knowledge about the sector.	4,00	5,00	0,02	*
C8	Project increased our participation in national R&D projects like ARDEB, TEYDEB, TTGV etc.	2,00	4,00	0,02	*
D3	New management positions were opened.	2,00	3,00	0,02	*
D8	We have been informed about the research funding opportunities in EU.	4,00	5,00	0,02	*

Table 5.24 continued

D10	We had new skills in national project proposal preparation.	3,00	4,00	0,02	*
D11	We had new skills in international project proposal preparation.	4,00	5,00	0,00	**
*	**Significant at 5% level, Mann-Whitney U Test**				
**	**Significant at 1% level, Mann-Whitney U Test**				

As can be seen from Table 5.24, partners doing both research and demonstration acquire significantly higher impacts from 12 of 47 impact factors. A5 shows that, **prototyping** is closely related with demonstration activities. D3, D8, D10 and D11 indicates that, demonstration activities **are better increasing organizations administrative capabilities** like proposal preparation, following EU funding opportunities and creates management positions in addition it has positive effect on marketing skills (A10). As a consequence, this situation positively affects taking part in national programmes (C8). B10 shows that, the organization took part in demonstration activities were **better at commercializing research result** since they are doing things which are closer to the market. They are also better at technology transfer and acquiring new technical and technological skills (A2, A9).

To sum up, for partners **it is necessary to take part in demonstration activities inside the project especially for earlier commercialization of their research efforts**. Although the funding rates are low, demonstration activities add a lot more and TÜBİTAK should also promote taking part in both activities in a project.

- **Hypothesis 11**

There are four main role segments in FP6 IST projects according to leadership. First of them is the project coordination. Every project have some work packages (WP) and a number of tasks under them. Thus, a partner may also be a WP leader or a task leader. Leading something is not a must inside the projects, so we can define the last category as "none" for partners who does not lead anything. Out of 34 survey participants; four of them were coordinators, 11 of them are WP leaders, 13 are task leaders and six do not have any leadership and we call them "none".

Leading partners are doing or organizing (and so learning) larger volumes of research, they have bigger part from IPR which brings economic benefits, they communicate with more partners and they have deeper relationships with them and they also take part in more administrative issues like project management and proposal preparation. This situation expected to bring them higher impacts which we test in hypothesis 11.

Table 5.25 Hypothesis 11

	Impact Factor	**Project Role**		**Asymp. Sig**	
		Coor. Or WP leader	**Task leader of None**	**p value**	**Level**
		Median1	**Median2**		
A1	We learned new technologies we have not used before.	5,00	4,00	0,01	*
A2	We transferred new technologies we have never used before.	5,00	3,00	0,00	**
A4	We acquired new scientific knowledge.	5,00	4,00	0,02	*
A5	We produced a new prototype.	5,00	4,00	0,02	*
A9	We acquired new technical and technological skills.	5,00	4,00	0,01	*
A10	We acquired new marketing skills.	3,00	2,00	0,00	**
A11	Throughout the project we published academic publications (journal paper, thesis, conference proceedings...).	5,00	4,00	0,00	**
A12	At the end of the project we acquired new intellectual property rights (patent, copyright etc.)	3,00	2,00	0,00	**

Table 5.25 continued

B3	Project increased productivity of our organization.	4,00	3,00	0,00	**
B9	We achieved new research funding.	5,00	3,00	0,00	**
B10	We earned financial income from commercialization of the research results.	3,00	2,00	0,03	*
C2	Project increased the number of our sectoral collaborations.	4,00	4,00	0,04	*
C3	As a result of the project we are following European Technology Platforms and other research networks better.	5,00	4,00	0,00	**
C4	By the help of the project we are monitoring our competitors better.	5,00	3,00	0,00	**
C5	We achieved new contacts.	5,00	4,00	0,00	**
C6	Project enhanced our collaboration with the partners we have already been collaborating with.	5,00	3,00	0,00	**
C7	Project partnerships decreased the risk of our R&D expenses.	3,00	3,00	0,02	*
C8	Project increased our participation in national R&D projects like ARDEB, TEYDEB, TTGV etc.	4,00	4,00	0,03	*
C9	By the help of the project, we set new relationships which will enable us to participate in international R&D programmes like FP and EUREKA	5,00	4,00	0,03	*
D1	Project personnel acquired new knowledge and skills.	4,00	3,00	0,00	**
D2	Number of post graduate degree personals in our organization has increased.	3,00	2,00	0,00	**
D3	New management positions were opened.	4,00	3,00	0,02	*
D4	New researcher employment positions were opened.	3,00	2,00	0,00	**

Table 5.25 continued

D5	New support service positions were opened.	3,00	2,00	0,02	*
D6	We set a new test and measurement laboratory.	5,00	4,00	0,04	*
D8	We have been informed about the research funding opportunities in EU.	5,00	4,00	0,00	**
D9	We achieved new knowledge and experience on managing international R&D projects.	4,00	3,00	0,00	**
D10	We had new skills in national project proposal preparation.	5,00	4,00	0,03	*
D12	Our organization gained prestige.	5,00	4,00	0,01	*
D13	Our organization's recognition in foreign research networks has increased.	4,00	3,00	0,01	*
D16	Project increased the number of our R&D personal.	5,00	4,00	0,00	*
*	**Significant at 5% level, Mann-Whitney U Test**				
**	**Significant at 1% level, Mann-Whitney U Test**				

As can be seen from Table 5.25, taking leading position has the biggest effect on the acquired impact we have tested so far. Partners in higher leading positions (project coordinator or WP leaders) **experiencing significantly higher impacts** on most of the impact factors than the partners who have smaller leading activities (task leaders or none). **One important figure is that, eight out of nine sub criteria for impacts on collaborations and sector knowledge is significantly different for these groups.**

- **Hypothesis 12-17**

We will not go in to detailed analyses about these hypotheses. We tested each of them and results are presented by Table 5.26.

Partners employing TÜBİTAK scholar holder are expected to have higher impacts since they are somehow familiar with research grants and their absorptive capacity may be higher (hypothesis 12). Purchasing equipments and setting a new R&D department both indicate a bigger role in the project and also specialization in a technology (hypothesis 13 and 14), this would bring higher impacts like increase in technological capabilities and increase in institutional gains like research infrastructures. So far when we talked about collaborations we meant collaborations with EU partners. It is useful to see beyond, what if they have set national partnerships and partners from non-EU high income countries like U.S., South Korea, Canada etc. (hypothesis 15 and 16). Moreover, submitting new projects with the partners you met in a consortium is an important process to be examined.

Partners who employ TÜBİTAK scholarship holders seem to have higher impacts from 19 factors out of 47. 15 of the survey participants indicated that they employ TÜBİTAK scholarship holder. Those partners seem to be more satisfied building collaboration and have higher institutional gains. When we look at scientific factors, we will realize that they are better at acquiring all types of new knowhow (A1,A2,A3) and coming up with tangible research outputs (A11, A12).

Turkish partners who bought equipment (26 partners) and set a new R&D department (10 partners) have higher impacts in similar factors. Mostly they are better in institutional impact and impacts on collaboration and sectoral knowledge with respect to the partners who did not.

Partnerships beyond EU reveal valuable information. As one organization is collaborating with more international or national partners, they have significantly more impact from most of the impact factors. In section 4.2.2, we have seen close correlations between scientific success of the project and collaborations. We have also seen that, more collaboration brings high quality knowhow and vice versa. Interestingly, test results for hypothesis 15 appear to be significant for most of the impact factors. 11 of the partners indicated that, they have set collaborations beyond EU (e.g. U.S., South Korea, Canada) using the knowhow they acquired from the project. Those partners are far more successful from the remaining partners in 37 out of 47 impact factors. 16 partners indicated that they used the knowhow coming from project in setting collaborations with national organizations (hypothesis 16). These partners indeed seem to be significantly more successful in 23 of 47 impact factors. FP6 programme supports international collaborative R&D project and as we have severally mentioned it is new to collaborate for a research project for Turkish participants. **This situation makes the partners who are eager to collaborate both nationally and internationally more successful.** Same finding is also valid for Austria's impact study[69], it indicates that the participant organizations already are experienced with cooperation.

So far, economic impact seemed to be less affected from control factors. This puts hypothesis 17 to a special position. 25 survey participants selected the choice "yes" when they were asked if they had submitted a new project with the partners they collaborate in FP6 IST project. When we tested hypothesis 17 we saw that those partners are significantly more successful in 7 factors, 6 of which are economic impact factors. Somehow partners who had higher economic impacts are eager to collaborate with consortium for submitting new projects. **Economic success of current collaboration might be an important facilitator for setting further proposals.**

Table 5.26 Hypothesis 12-17

	H12	H13	H14	H15	H16	H17
A1			*	*	**	
A2	*	*		*	*	
A3	*		*	**		
A4	*	**		**	*	
A5				*		
A6			*	**	*	
A7					*	
A8		**	**			
A9		**	**	**	*	
A10				*	*	
A11	**			**	**	
A12	**			**	**	**
B1				*	*	*
B2						
B3	*			*		
B4				**		
B5				*	*	*
B6			**	*		*
B7				*		*
B8				*		
B9	**	*		**	*	*
B10				*	*	*
C1		*	*			
C2	**	*	**	**		
C3	**	*		**	**	
C4	*	**	**	**	**	
C5	**	**		**	**	
C6	**	*	*	**	**	
C7						
C8				*		
C9	**	*		**		
D1		**		**		
D2	**	*	*	**	**	
D3		**	**	*	*	
D4	**		**	*	*	
D5		**	*		*	
D6						
D7	*	*				
D8		*	*	**		
D9	**	**	*	*		
D10		*	**	**		
D11			**	*		
D12	*	**		**	*	
D13	*	**		**	*	
D14			**			
D15			**	*		
D16		***	**			

*** Significant at 5% level, Mann-Whitney U Test**
**** Significant at 1% level, Mann-Whitney U Test**

- **Hypothesis 18**

Last but not the least we will test the effect of received grant on impact factors. We hypothesise that, the project partners who received higher grants are eager to have higher impacts from the projects. We have divided the partners into two groups according to the grant they received from the project; 34 survey participants retained grants between 4900 Euros to 1244661 Euros. Group one consists of the projects having grants between 182000 Euros to 1244661 namely the top 17 grant winners. Second group consists of the remaining 17 grant winners having grants between 4900 Euros to 176125 Euros.

Table 5.27 Hypothesis 18

	Impact Factor	**Received Grant**		**Asymp. Sig**	
		Group one	**Group two**	**p value**	**Level**
		Median1	**Median2**		
A1	We learned new technologies we have not used before.	5,00	4,00	0,01	**
A5	We produced a new prototype.	5,00	3,00	0,01	*
A6	We produced a new software.	5,00	4,00	0,01	*
A7	We produced a new standard/norm.	4,00	2,00	0,03	*
A9	We acquired new technical and technological skills.	5,00	4,00	0,04	*
A10	We acquired new marketing skills.	3,00	2,00	0,02	*
C4	By the help of the project we are monitoring our competitors better.	5,00	3,00	0,04	*
D9	We achieved new knowledge and experience on managing international R&D projects.	5,00	4,00	0,02	*
D11	We had new skills in international project proposal preparation.	5,00	4,00	0,04	*
*	**Significant at 5% level, Mann-Whitney U Test**				
**	**Significant at 1% level, Mann-Whitney U Test**				

The partners having higher grants are having higher impact in nine of the impact factors. Most significant outcome is the effect of money on scientific and technological impact. **Having more grant somehow means having more scientific and technological impacts.** Another interesting finding is seen on economic impacts. **Economic impact is not very much related with the acquired grant.** It is seen that higher grant winning partners are better in monitoring their competitors. Higher grant earners are also better at proposal preparation and managing. The bigger grant means bigger roles. When they have bigger roles they are more involved in project management and they add more in the preparation phase; this brings experience and skills.

5.2.4. Additionality level of participating in FP6 IST programme

In section 2.3 we have explained additionality concept and so far we have analyzed the survey questions related with additionality. In this section, we will evaluate the additionality for Turkish participants.

5.2.4.1 Level of input additionality

Question 4 in the survey was designed in order to collect participants' view on input additionality of FP funding. We asked them: **What would you do if your project was not funded?** The results can be seen from Figure 5.10.

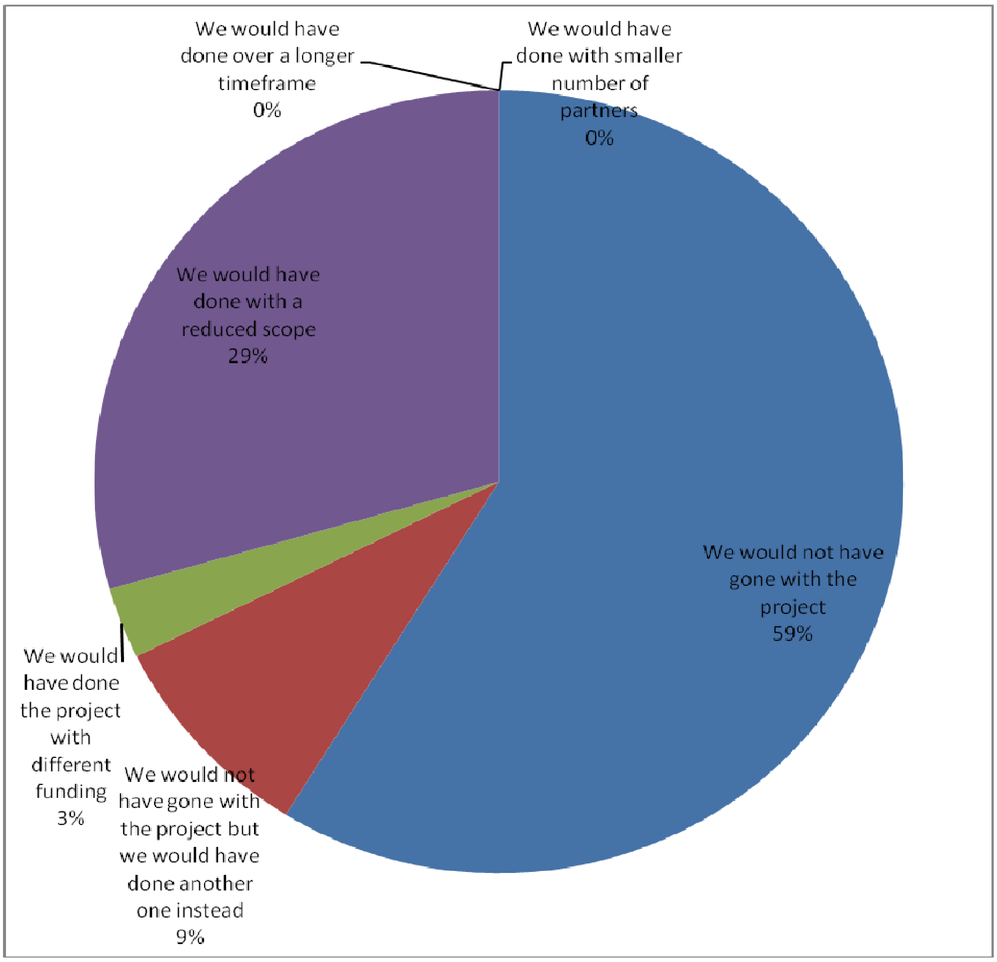

Figure 5.10. Participants views on additionality of FP funding.

The vast majority of the Turkish partners, 59%, would not have gone ahead without FP funding. This demonstrates that **FP IST field is funding absolutely additional projects** from the Turkish partners' point of view. However, we must indicate that, this ratio is much higher in other countries, it is 70% in Austria[69] and UK[82] and 82% in Ireland[76].

A minority, 9% of participants indicated that they would have gone with a different project if they were not funded by FP. Therefore, we can say that **FP has displaced alternative projects** for a few numbers of participants. 3% of participants express that, they would have done the project with a different funding source, justifying the **project are considerably important for them**. 29% of participants confirmed that they would still go on with the project but with a reduced scope, however none of the participants tends to go on with the project on a longer timeframe or with fewer partners. **This proves that, FP has partial additionality since it allows projects to go on with a wider scope, while it does not help the projects to proceed more quickly or with more partners for Turkish participants. Studies on Austria, UK and Ireland demonstrate that the participants in those countries believe that FP funding has some other additionalities for instance it shortens the project duration or enables it to proceed with more partners, which is not the case in Turkey.**

Additionality of STREP projects are higher that IP and NoE projects.

13 out of 15 STREP projects; 2 out of 6 IP projects and 5 out of 13 NoE projects indicated that they would not go with the project without FP funding. The percentage is 87% for STREP projects and 33% and 38% for IP and NoE projects.

Additionality is higher for SMEs.

8 of 11 SMEs, 12 of 21 universities indicated that they would have not gone with the project without FP funding. Remaining one industrial organization and one research centre indicated that they would have done the project with a reduced scope. 73% of SMEs would not have conducted this research without FP; the percentage is 57% for universities. This point out that additionality of FP6 IST is recognized mostly by SMEs.

Academia is more willing to run the same project with a reduced scope.

Results show that, 9 of 22 academia representatives and 1 of 12 industry/business organizations would have done a new project with a narrower scope if they were not funded. This shows that additionality to the scope of the project is without doubt higher for academia.

5.2.4.2 Level of behavioural additionality

Jari Hyvärinen and Anna-Maija Rautiainen suggest three basic elements for behavioural additionality; additionality on R&D project, capabilities and competences[32]. Summarized in Table 5.28 questions 6, 7, 8 and 19 of the survey attempts to collect information about human capital, networking, partnerships and collaborations which are elements of behavioural additionality.

Table 5.28 Level of behavioural additionality

	Survey Question	**# of yes**	**# of no**
Q6.1	Have you set collaborations beyond EU (e.g. U.S., South Korea, Canada) using the knowhow you acquired from the project?	11	23
Q6.2	Have you set national collaborations using the knowhow you acquired from the project?	16	18
Q7.1	Did you take part in an ARDEB project in the similar topic with your FP project?	6	28
Q7.2	Did you take part in a TEYDEB project in the similar topic with your FP project?	9	25
Q7.3	Did you take part in a TTGV project in the similar topic with your FP project?	3	31
Q7.4	Did you take part in an SANTEZ project in the similar topic with your FP project?	0	34
Q8	Did you make any other project applications with the same partners in the consortium?	25	9
Q19	How many post-graduate personal joined to your team after the project?	16	9

11 of survey participants have set contacts in high-income countries and 16 have set connections with national organizations (Q6). 25 of the participants submitted new projects with current partners (Q8). We can conclude that, there is behavioural additionality on the way they collaborate, network and find partners in all three levels: in EU, in Turkey and beyond EU. When we analyze national partnerships further we can see that 18 more project were submitted to national funding in the

similar topic (Q7). **We can say that FP topics do not substitute but go parallel with national R&D subsidies as it is in Austria[69].** Projects have also behavioural additionality in human capitals. 16 survey participants stated that they have increased the number of post-graduate personnel in their organizations (Q19), with a total of 53 new personal. Nine said that, project did not increase their post-graduate positions and nine did not answer to this question. **Behavioural additionality is experienced mostly on capabilities of collaborating, networking and partnerships.** The similar results are also seen in Swedish impact study[77], they indicate that FPs have clearly added size and scope of researchers' networks. Behavioural additionality in Turkey is also felt in human capital.

5.2.4.3 Level of output additionality

A series of open-ended numerical entry questions were asked to the participant in questions 9 to 17. Table 5.29 summarizes the responses. The questions were not from the obligatory questions since for some institutions it is hard to collect such data.

Response rates for the output questions were quite low. In questions Q9-12 we asked participants their financial enhancement like increase in sales, exports and income. Only five participants entered a numerical value for those questions. 14 participants did not answer and 15 indicated that they have had not experienced such an output. In section 5.2.1 the level of economic impacts was the lowest of all. This finding is supported by the outputs. **Participants do not realize high real incomes from the projects for now.** In the following years this figures may be higher.

In questions Q13-16 we asked participants the number of tangible outputs they produced during the project. 10 participants produced 18 new products in total, 12 did not produced a product. 24 new software products were produced by 16 participants, nine did not produce any software. 16 participants took part in production of 30 prototypes, nine did not. Only 11 new standard/norms were developed in projects and 8 Turkish partners took role; 11 did not. **Turkish participants are highly involved in prototyping and software production. Involvement in producing new products and developing new standard/norms is quite lower.** In UK less than one third of participants produced products or services[82].

Table 5.29 Level of output additionality

		Answered			No answer
	Question	# of numerical entry	# of answer saying "0"	Output figure	
Q9	What is the percentage increase of your sales you experienced because of the project?	5	15	N/A	14
Q10	What is the percentage increase of your income from sales you experienced because of the project?	5	15	N/A	14
Q11	What is the percentage increase of your export you experienced because of the project?	5	15	N/A	14
Q12	What is the percentage increase of your patent, expertise (knowhow) income you experienced because of the project?	5	15	N/A	14
Q13	How many new products you produced throughout the project?	10	12	18 new products in total	12
Q14	How many software you produced throughout the project?	16	3	24 new softwares in total	15
Q15	How many prototypes you produce throughout the project?	16	9	30 new prototypes in total	9

Table 5.29 continued

Q16	How many standard/norm you developed throughout the project?	8	11	11 new standard/norm in total	15
Q17	How many academic publications (journal paper, thesis, conference proceedings...) you published throughout the project?	27	6	328 publications in total	1
Q19	How many post-graduate personal jonied to your team after the project?	16	9	53 new positions in total	9

The highest output was achieved in the number of academic publications. 33 of 34 participants answered this question; and 27 of them published 328 academic publications in total. **We can say that FP6 IST had high impacts in academic publications.** The situation is similar for Czech participants[71]; citation rates are 21% higher than average for those, and there is an increase of 200% in papers. In UK all projects publish at least one journal article[82]. On the other hand, bibliometric effect is not apparent for Sweden[77]. Again projects increased the post-graduate employee numbers in 16 organizations by 53 and for nine participants there is no increase in this output. In Switzerland, every project creates two jobs, %20 of the participants contribute establishment of a start-up or spin-off and generating jobs in longer terms; they are also less effective in producing patent, 29% expects patents in three years time, while other IPR forms like copyright and trademarks are three to four times more common in their projects[80].

5.3 Concluding Remarks:

34 participants received grants from FP6 IST field were questioned in our survey. First, we discussed their level of impacts from four main impacts factors. Participants had high impacts in scientific and technological impact factors. Average score for 12 impact factors was 3,59 over 5. 90% of them agreed that they had new scientific knowledge from the projects. They agreed on that projects were quite successful in acquiring new knowledge and skills. Academic publications, software and new prototypes were most common outputs. The less effective impacts were on producing new standards/norms, acquiring marketing skills and intellectual property rights. we asked them how successful the projects were in economic impact factors. Receiving new research funding had a score of 3,62 far more than other real incomes like new products, increase in sales or exports. Economic impacts appeared to be lower compared with other factors. We identified impacts on collaborations and sectoral knowledge. These factors had the highest scores among four main impact factors. Participants indicated that, they had new contacts, increased collaborations, entered in new research networks by the help of the projects. The lowest impact for this factor tends to be increased participation in national projects. After that, some other institutional impacts were questioned. Participants indicated that they had high impacts in knowledge and skill levels of project personnel, gaining visibility and prestige, taking part in international research projects. The impacts were lower in infrastructure development like setting a new research or test and measurement laboratory.

Second, we examined correlations between impacts. For scientific and technological factors, acquisition of new knowledge and skill was highly related with software development revealing that these skills were mostly used in software production. For economic factors, economic gains from the projects were both effective in domestic and international markets. Correlations between collaborations and sectoral knowledge factors showed that, following European research networks, monitoring competitors and setting new partnerships for future collaborations were all highly correlated. New contacts are set in European networks and they are crucial for monitoring competitors and setting future joint proposals. Correlations between other institutional impacts showed that once the participants get involved, they achieve new knowledge in preparing and managing international research proposals. Prestige of the organization increases by taking part in new research networks. Once they increase R&D spending, they increase the number of their R&D personnel.

Third we discussed the effects of some control factors on achievements. We tested our 18 hypotheses to find out who benefits and how. IP and STREP participants seemed to have slightly higher scientific and technological and economic impacts when compared with NoE proposals. Despite we were claiming that NoE participants were better at collaborations and increase in sectoral knowledge, this was not supported by our statistical tests. Research organizations were more successful than industrial/business organizations in collaborations and some of the intuitional gains. However, there is no significance difference in economic impacts and scientific and technological gains. When we consider project activity, partners doing research seemed to have higher impacts in all factors except for economic impact factors when compared with the partners who just took part in demonstration activities. The situation was similar for partners taking part in both research and demonstration compared with partners just did research. Doing both resulted in higher impacts showing the importance of taking also part in demonstration activities. Project role seemed to have great impact on achievements. Being coordinator of work package leader bring rather high impacts when compared with task leaders or no leadership in all impact factors. Project role seemed to be one of the most important control factors. We tested the effects of employing TÜBİTAK scholar, purchasing new equipment, setting new R&D departments, setting partnerships beyond EU, setting national partnerships and initiating new proposals with same partners between hypotheses 12 – 17. All of these factors seemed to have positive effects on impacts. Most significant finding was that, partners who are eager to collaborate both nationally and internationally were far more successful. Moreover, economic success of current collaborations seemed to be important facilitator for setting future proposals. Since research funding is a matter of money, in hypothesis 18 we tested the effects of received grant on impact achievement. The results showed that, having more grant somehow meant to have more scientific and technological impact. Surprisingly, economic impact did not seem to be much related with received grant.

Having the information from both participant and decision makers' sides, in the newt section we will compare the expectations and achievements.

5.4 Comparison of decision makers' expectations and participants achievements

We are looking for the answer of the question: To what extent expectations of decision makers were satisfied?

Strengthening the scientific and technological basis of the industry and encourage its international competitiveness while promoting research activities in support of other EU policies was the main objective of FP6 [91]. Turkey has very limited or no impact on the EU policies. We provide financial contribution from our national budget to the project which we desire to be used efficiently. For this reason, it is important to take into consideration main stakeholders' expectation from the projects and how well these expectations were met. In the above sections, in our Delphi study, we have constrained decision makers with 100 points to be separated to 49 impact factors according to their priorities. This gave us the ranking in their minds. We also have some figures about the impact achievement for those factors.

In participant survey we have evaluated feelings of the participants about the level of their achievement in the impact factors; however in Delphi we forced decision makers to rank the impact factors according to their priorities and expectations. Thus, we do not find it scientifically reasonable to do statistical tests (e.g. rank correlation) between the answers. While we still may come up with some interpretations.

In general decision makers are valuing scientific and technological effects and outputs as the most important impact factor. This factor has a average score of 3,59 out of 5 in participant survey from Likert questions and it is coming second after their impact on collaborations and sectoral knowledge which has 3,69 out of 5. Similarly collaborations and sector knowledge is ranked second in Delphi survey. We can say that participants had considerably high impacts in these two main impact factors and decision makers' expectations were met.

Economic impacts were ranked third in Delphi study with a slightly lower score. Yet, economic impacts were the lowest among all factors in participant survey scoring 2,67. Participants hardly agree that they had positive economic impacts from the project. It is unlikely that the participants were able to achieve as high economic impacts as decision makers were expecting. Its economic impacts on growth were emphasized as one of two rationales of public R&D supports in section 2.1. This situation is also valid for EU, since the main aim of the programme is to encourage industries competitiveness. Whereas, it is difficult to link the participation in the programme to the economic performance and success of the firms, for reasons related to attribution of effects and pre-competitiveness[88].

Other institutional impacts were considered to be less important by the decision makers when compared with the other three impacts. In any case participants seem to have enjoyed positive impacts in this criterion.

When we go in detail we will see the following findings:

- **Scientific and technological impacts**

We can say that, achievements of participants in acquiring new knowhow are almost in line with decision makers. When we look at business outputs, we could say that decision makers were expecting slightly more standard and norms to be developed. For the new skills developed, participants were more successful in developing managerial skills than expected. Number of publications was far more than expected while it is just opposite for number of patents and IPR rights.

- **Economic impacts**

New product formation was highly important for decision makers; their expectation was not met properly. Access to domestic markets was not one of the priorities of the Delphi participants, while projects were effective on this issue. The same situation is valid for access to new research funding; stakeholders did not consider this to be an important impact. While high number of participants from university considered this factor as an important economic gain. It is clear that decision makers were expecting a higher success in financial gains from commercialization of research results.

- **Development of sector knowledge and collaborations**

Monitoring competitors have had the highest ranking from the decision makers; this expectation is unlikely to be met. Increase in national R&D programme participation was very unnecessary for decision makers, while it was achieved somehow by the participants.

- **Other institutional impacts**

Delphi participants highly ranked foundation of an R&D department in a specialized topic which was not realized much by Turkish partners. The same situation is valid for purchasing new equipments. As it is in above examples, decision makers did not value impacts regarding additionalities in national level very much; however participants got some advance in national project preparation. Stakeholders did not list new employment positions as high priorities, while participants experienced it.

CHAPTER 6

CONCLUSION

6.1. Participation in FP6 IST field:

FP6 took place between years 2002 – 2005, and Turkey officially took part in the programme after January 9, 2003. 72 Turkish partners were funded under FP6 IST field, with a success rate of 10.5%. Turkey's success rate is lower than programme average which is 18.4%. **Vast majority of the applications for FP6 IST field are based in Ankara and İstanbul.** Ankara has the highest number of supported proposals. **Universities (46%) and SMEs (23%) have the highest application figures in total.**

6.2. Expectations of decision makers:

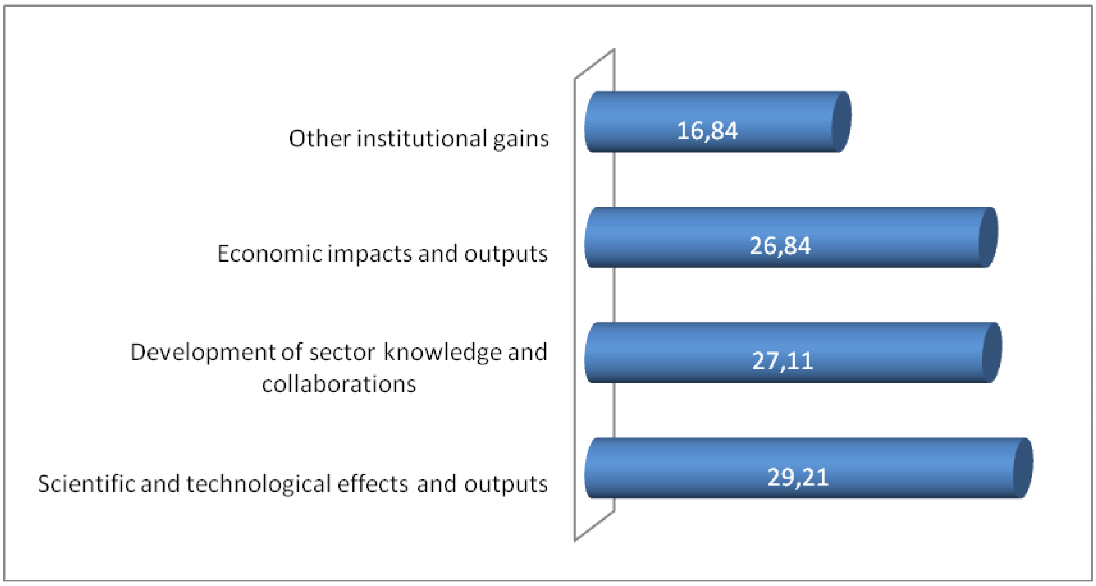

Figure 6.1. Delphi ranking for main impact factors

Results of the Delphi study show that, **decision makers value scientific and technological effects and impacts of the programme as the most valuable outputs (Figure 6.1)**. Acquiring new technologies, skills, improved research methods and equipments are the most important impact factors for them. Business outputs like software, prototypes, standards and norms come second. **They are not very much interested in acquiring new managerial and marketing skills, which might be the reason for low level of economic impacts, or number of dissemination materials and publications.**

Development of sector knowledge and collaborations was ranked second by the Delphi participants. EU FP is different from traditional R&D support programmes in Turkey since they promote international R&D collaboration. **Delphi participants were well aware of this situation and they see networking as an important part of research**. Especially for industry and business organizations, they think that monitoring global competitors is the most important effect of the programme. **In fact, this factor has the highest ranking among all 49 factors decision makers ranked.** Entering new research networks via membership to European Technology Platforms, acquiring new contacts especially for international projects and as a consequence sharing risk and cost of R&D are other expectations for them. **Decision makers do not see it important to set new national contacts as a consequence of FP6 IST field participation**.

Despite the fact that R&D subsidies globally target competitiveness and economic growth, decision makers ranked economic impact factor in the third place. **Although, they still highly value economic impacts, they are thinking that economic impacts are not immediate outputs of FP programme, in other words scientific and technological gains and development of collaborations and sectoral knowledge are more crucial in this phase.** The most important economic output for them is the new product formation. They would like to see financial input from commercialization. They value increase in export more than increase in total sales. Access to new domestics markets is not an important output of FP IST field participation for them.

Other institutional gains are ranked last in Delphi survey. **Although these factors include very important parts, they do not value those as crucial outputs of FP participation**. Added visibility for the organization and training of personnel are the two most important outcomes for them. They, then, support infrastructure development via setting up new laboratories and purchasing new equipments.

6.3. Level of impacts:

In this thesis four main impacts were calculated: scientific and technological impact factors (A), economic impact factors (B), impacts on collaborations and sectoral knowledge (C) and other institutional impacts (D). Impact levels are high except for economic impacts (**Figure 6.2**).

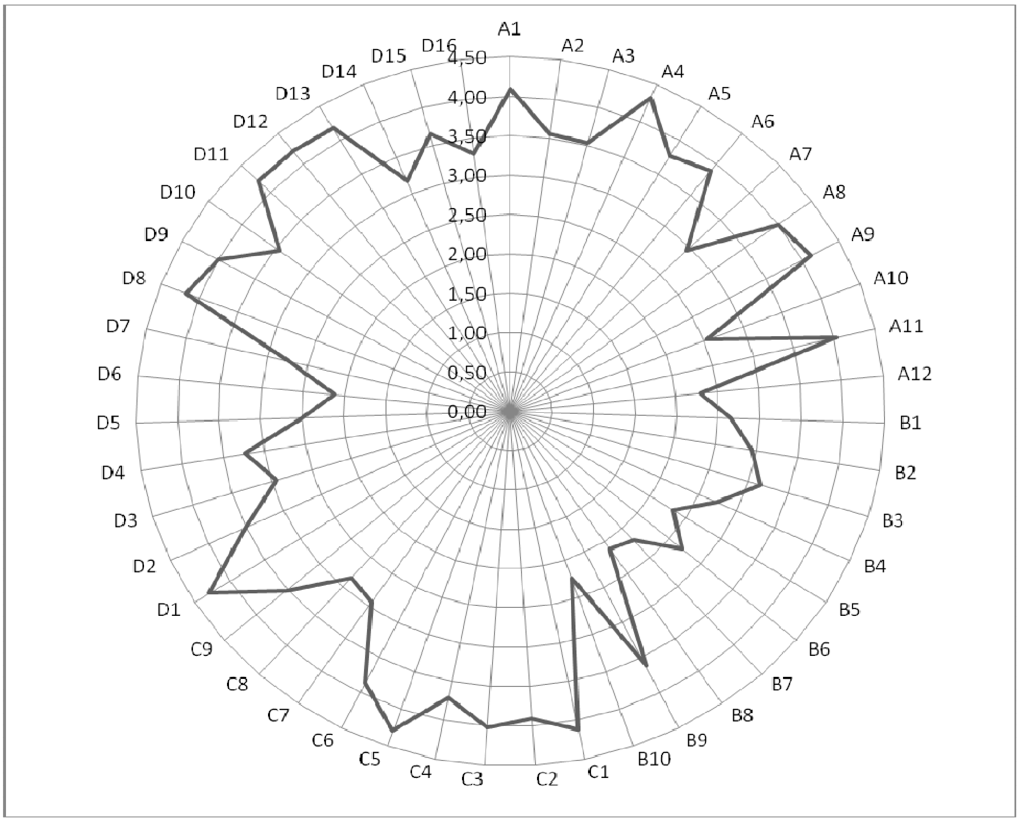

Figure 6.2 Radar chart for all impacts.

Participants acquired high impacts in terms of scientific and technological impact factors. **More than 90% of participants indicate that, they had enhanced their scientific knowledge base by the help of the project.** They have acquired new technical and technological skills; they have learned new technologies they have not used before. One of the most significant outputs of participation is publishing on academic journals. This is followed by new software, prototypes and lastly new standard and norms. **Turkish participants were the most active in producing new software which cannot be patented. This may be one of the reasons behind low success in acquiring new intellectual property rights.**

Level of economic impacts is lowest among all impact factors. **Achieving new research funding is listed as the first among economic impact factors.** This can be thought as a real income just for academic institutions. Participants mostly agree on that participation has increased their productivity; they have produced more qualitative products, services and processes. **However, they do not see themselves successful in producing brand new products. Real income factors like increase in sales, exports and earnings from commercialization of research results are quite low.** Anyway, they see themselves more successful in reaching new international markets than reaching new domestic markets by the help of participation. This situation should not be interpreted that FP6 IST projects does not have any economic impacts. **The projects are aiming at future technologies and economic impacts are expected to be more in the long run.** Moreover, it is not easy to assess and/or measure the economic impacts by the participants.

Highest level of impact is measured in collaborations and sectoral knowledge. FP6 IST field was very successful in enhancing participants' research networks. It also suggests the potential knowledge spillovers from project partners to Turkish research area. More than 90% of the participants indicate that they have set new contacts. **They have enhanced their existing collaborations and started to take part in European research networks.** As a result, they were better in monitoring their competitors and they were able to set good connections for future EU research funding. **The impact of the programme on sharing risks is not clear and its impact on national collaborations is substantially lower**.

Level of institutional impacts varies. **In total, the impacts are quite high.** More than 90% of the participants agree on that project enhances personnel skills; they are also somehow beneficial in opening of new positions. **Participants gain important skills in managing and preparing international projects.** Another important impact factor is realized in participants' increased prestige and recognition in international research networks. **This reorganization has already supported some partners in taking part in new project in FP7 ICT field.** Measured impact for infrastructure development is not high**. Participants do not feel that the project had supported them much in setting new research or test and measurement laboratories.**

6.4. Relations between impacts:

Correlations between scientific and technological impact factors offer high relations between learning new technologies, acquiring new technical and technological skills and starting to use new or substantially improved methods and equipments. **All of those factors are highly related with producing new software, showing that, acquired knowledge and skills were mostly transferred into software development.**

Relations between economic impact factors indicate that, increase in sales and export is parallel with producing new products, services and processes. Increase in domestic and international market shares is highly correlated. **Once the project results are commercialized, this situation brings positive effects on both sales in domestic and world markets**.

Correlation between collaboration and sectoral knowledge factors show that organizations operating in similar sectors also follow similar research networks. Being in European research networks are good for setting new research connections and has a leverage effect in winning R&D funding from EU programmes. **New contacts are eager to be used as project partnerships for future proposals.**

When we consider correlations under institutional gains we can say that one of the most important skills acquired is being informed about funding opportunities in EU and achieving knowledge and experience about project preparation, moreover, this brings prestige. **When people write and lead proposals, they get in contact with more people and so they are more recognizable in international research networks.** Opening of new research and management positions are parallel. **An important part of increase in R&D investment is related with increase in R&D personnel**.

Overall relations between all factors show that networking is very important for knowledge acquisition. As the partners are successful in acquiring new knowledge, they increase their prestige and they are widely accepted in international research networks. Acquiring new skills is an indicator of being in right consortiums and following right technologies. Having new contacts, partners have started to lead proposals and had more research funding. As a consequence, those partners are also successful in monitoring their competitors. The skills coming from EU projects are so qualified that, they are easily accepted as national projects. The ones who were able to acquire new marketing skills were able to reflect this competence in their sales and business processes.

6.5. Who benefits and how?

We identified effects of some control factors on impacts testing 18 hypotheses. The main findings are listed below:

- Partners taking in IP and STREP projects appeared to have higher impacts mostly on economic impact factors.
- NoE projects were not successful in developing collaborations and sectoral knowledge as we have hypothesised. This might be the case because Turkish participants are at early stage and immature before being a centre of excellence.
- Research organizations were more successful than industrial/business organizations in collaborations and some of the institutional gains. However, there is no significant difference between economic impacts and scientific and technological gains.
- Partners doing research seemed to have higher impacts in all factors except for economic impact factors when compared with the partners who just took part in demonstration activities.
- Considering project role, it is When we compare partners taking part in both research and demonstration activities with partners just doing research we see that, doing both resulted in higher impacts showing the importance of taking also part in demonstration activities.
- **Project role seemed to have a great impact on achievements.** Being coordinator or work package leader bring rather high impacts when compared with task leaders or no leadership in all impact factors.
- We tested the effects of employing TÜBİTAK scholar, purchasing new equipment, setting new R&D departments, setting partnerships beyond EU, setting national partnerships and initiating new proposals with same partners between hypotheses 12 – 17. All of these factors seemed to have positive effects on impacts. **Most significant finding was that, partners who are eager to collaborate both nationally and internationally were far more successful.** Moreover, economic success of current collaborations seemed to be important facilitator for setting future proposals.
- Having more research grant somehow meant to have more scientific and technological impact. **Surprisingly, economic impact did not seem to be much related with the received grant**.

6.6. Additionality:

In the content of input additionality, we conclude that, the vast majority of the Turkish partners, 59%, would not have gone ahead without FP funding. This demonstrates that **FP is funding absolutely additional projects** from the Turkish partners' point of view. 9% of participants indicated that they would have gone with a different project if they were not funded by FP. Therefore, we can say that **FP has displaced alternative projects** for a few number of participants. 3% of participants express that, they would have done the project with a different funding source, justifying the **project is considerably important for them**. 29% of participants confirmed that they would still go on with the project but with a reduced scope, however none of the participants tends to go on with the project on a longer timeframe or with fewer partners. **This proves that, FP does not help the projects to proceed more quickly or with more partners for Turkish participants.**

Considering project instrument we can indicate that, additionality of STREP projects are higher than that of IP and NoE projects. Input additionality is higher for SMEs. Academia is more eager to run the same project with a reduced scope among other organization types.

When it comes to behavioural additionality, we can confirm that behavioural additionality is experienced mostly on capabilities of collaborating, networking and partnerships. Behavioural additionality in Turkey is also felt in human capital. 16 of the 34 participants indicated that they have increased the number of post-graduate personnel in their organizations by 53 new staff members.

Output additionality analyses show that, participants do not realize high real incomes from the projects for now. **Turkish participants are highly involved in prototyping and software production.** Involvement in producing new products and developing new standard/norms is quite lower. **We can say that FP6 IST had the highest outputs in academic publications.**

6.7. To what extent expectations of decision makers were satisfied?

Decision makers' expectations were highly satisfied in scientific and technological impact factors and in developing collaborations and sectoral knowledge. They did not value other institutional gains highly; however, participants were quite happy with those gains. The gap is seen on economic impact factors. We can report that, the economic expectations of the decision makers were not met by the FP6 IST field.

When we look at business outputs, we could say that decision makers were expecting slightly more standard and norms to be developed. For the new skills developed, participants were more successful in developing managerial skills than expected. The number of publications was far more than expected while it is just opposite for the number of patents and IPR rights.

New product formation was highly important for decision makers; their expectation was not met properly. Access to domestic markets was not one of the priorities of the Delphi participants, while projects were effective on this issue. The same situation is valid for access to new research funding; stakeholders did not consider this issue to be an important impact. While high number of participants from university considered this factor as an important economic gain. It is clear that decision makers were expecting a higher success in financial gains from commercialization of research results.

Monitoring competitors have had the highest ranking from the decision makers; this expectation is unlikely to be met. Increase in national R&D programme participation was very unnecessary for decision makers, while it was achieved somehow by the participants.

Delphi participants highly ranked foundation of an R&D department in a specialized topic which was not realized much by Turkish partners. The same situation is valid for purchasing new equipments. As it is in above examples, decision makers did not value impacts regarding additionalities in national level very much; however participants got some advance in national project preparation. Stakeholders did not list new employment positions as high priorities, while participants experienced it.

6.8. Final Remarks:

In general we can indicate that, EU FP6 IST field participation was very valuable for Turkish organizations in acquiring new scientific knowledge. Participants think that they have taken part in high quality research; moreover, industrial/business organizations increased their knowledge about their sectors. The projects were also important for increasing skills and experience level of personnel worked for the project. Participants set new research connections, increased their prestige and visibility and learnt about EU funding opportunities; as a consequence they took part in EU research networks and caught new contacts for future proposals. Most significant tangible output of the projects was publications. Academia achieved a high number of academic dissemination by the help of the projects; it was followed by software and prototype development, while the impact is lower in acquiring intellectual property rights. The real economic impacts were the lowest of all, increase in exports, sales; reaching new international and domestic markets were not one of the common outputs of the projects. The projects have some positive impact on enhancing research infrastructures and human resources for research.

IP and STREP projects were more successful when compared with NoE projects. Although it is their main target, NoE projects were not significantly better in setting permanent research collaborations. Academic institutions appeared to be more successful in setting new collaborations and in some of the institutional impacts. However, there is no significant difference between industry and academia in economic and scientific impact factors. Our study supports the fact that, participants should not stay far from demonstration activities, although funding percentages for these activities are lower, partners taking part in both research and demonstration are getting higher impacts. The most important factor affecting the impact level is the role of the organization in the project. Having important roles like being coordinator or work package leader is extremely significant for having greater impacts. One of the most significant findings was that, partners who are eager to collaborate both nationally and internationally were far more successful. Finally, economic impact did not seem to be much related with the amount of received grant.

59% of participants indicated that they would not go on with the project without FP funding. This shows a high level of input additionality, on the other hand, the ratio is higher for other countries like England, Ireland and Austria. Input additionality was higher in STREP projects and for SMEs. Behavioural additionality is mostly felt in collaborations, networking and partnerships. Output additionality is significant in academic publications. It is also felt in producing new software, prototype; dissimilarly, the impact is lower in producing brand new products, standards and norms as well as intellectual property rights.

Decision makers' expectations were mostly satisfied by participants except for economic impacts. We can expect to see economic impacts better in the long run. We should also notice that, participants would not have been able to identify economic benefits they are already experiencing.

Now Turkey is taking part in Seventh Framework Programme which will end in 2013. Eighth European Framework Programme (FP8) will start in 2014 and last in 2020. It is expected that, European Commission will start preparation for the programme in 2011. Partner countries have already started to set their visions about FP8. TÜBİTAK has initiated a national consultation process on FP8 to collect Turkish Research Area's views.

Being an associated country, Turkey will discuss and decide whether to participate or not participate in FP8 and in forthcoming FPs. This thesis illustrated that, Turkish participants in FP6 IST field had significant impacts in three out of four main impact factors. Moreover, decision makers expectations were highly satisfied except for economic impact factors. Lower levels of achievements in economic factors were already expected since the programme was aiming at future technologies and economic impacts are expected to be significant in the long run. **The results of this study, relying on the assessed impacts of FP6 IST field, support the idea of participating in the forthcoming FPs for Turkey.**

In addition to all, this thesis provides input for further research. When compared with FP6 IST field, FP7 ICT field is more theoretical. Industry participation in the programme declines year by year. A further study comparing the difference of impacts of those two programmes may be object to further research. Since academic publications are the most visible output of projects, a bibliometric study like Hungarian example may be interesting. Turkish participants are successful in setting collaborations, networking and partnerships. These patterns may be further analysed through social network analyses.

REFERENCES

1. Wolff, G.B. and V. Reinthaler, *The effectiveness of subsidies revisited: Accounting for wage and employment effects in business R&D.* Research Policy, 2008. **37**(8): p. 1403-1412.
2. Steil, B., V.G. David, and R.R. Nelson, *Technological Innovation and Economic Performance*. 2002, New Jersey: Priceton University Press. 476.
3. Schumpeter, J.A., *Capitalism, Socialism and Democracy*. 3rd ed. 1942, New York: Harper.
4. Solow, R.M., *Technical Change and the Aggregate Production Function.* The Review of Economics and Statistics, 1957. **39**(3): p. 312-320.
5. Aghion, P. and P. Howitt, *A Model of Growth Through Creative Destruction.* Econometrica, 1992. **60**(2): p. 323-51.
6. Arrow, K., *The economic implications of learning by doing* ReviewofEconomicStudies, 1962. **29**(2): p. 155-173.
7. Romer, P.M., *Endogenous Technological Change.* Journal of Political Economy, 1990. **98**(s5): p. S71.
8. Davidson, C. and P. Segerstrom, *R&D Subsidies and Economic Growth.* The RAND Journal of Economics, 1998. **29**(3): p. 548-577.
9. OECD, *R&D and Productivity Growth: Panel Data Analysis of 16 OECD Countries*. 2001/II.
10. Lach, S., *Do R&D Subsidies Stimulate or Displace Private R&D? Evidence from Israel.* Journal of Industrial Economics, 2002. **50**(4): p. 369-390.
11. Trajtenberg, M., *R&D Policy in Israel:An Overview and Reassessment*. 2000, Tel Aviv University, NBER and CIAR Tel Aviv.
12. Klette, T.J., J. Møen, and Z. Griliches, *Do subsidies to commercial R&D reduce market failures? Microeconometric evaluation studies.* Research Policy, 2000. **29**(4-5): p. 471-495.
13. Eaton, J. and S. Kortum, *Engines of growth: Domestic and foreign sources of innovation.* Japan and the World Economy, 1997. **9**(2): p. 235-259.

14. Grossman, G.M. and E. Helpman, *Endogenous Innovation in the Theory of Growth.* Journal of Economic Perspectives, 1994. **8**(1): p. 23-44.
15. Guellec, D. and B.V.P. De La Potterie, *The Impact of Public R&D Expenditure on Business R&D.* Economics of Innovation and New Technology, 2003. **12**: p. 225-243.
16. Özçelik, E. and E. Taymaz, *R&D support programs in developing countries: The Turkish experience.* Research Policy, 2008. **37**(2): p. 258-275.
17. Federal Government of Canada, *Methods for Assesing the Socio-economic Impacts od Government S&T*, Working Group on S&T Financial Management Mechanism, Editor. 1993.
18. Melkers, J. and S. Cozzens, *Developing and Transferring Technology in State S&T Programs: Assessing Performance.* ournal of Technology Transfer, 1997. **22**(2): p. 27-32.
19. Bach, L. and L.G. Georghiou, *The Nature and Scope of RTD Impact Measurement*, in *International Worksop on Measurement of RTD Results / Impacts* 1998: Brussels.
20. Segerstrom, P.S., T.C.A. Anant, and E. Dinopoulos, *A Schumpeterian Model of the Product Life Cycle.* American Economic Review, 1990. **80**(5): p. 1077.
21. Ruegg, R. and I. Feller, *A Toolkit for Evaluating Public R&D Investment Models, Methods, and Findings from ATP's First Decade*. 2003, Gaithersburg.
22. Georghiou, L., *Issues in the Evaluation of Innovation and Technology Policy.* Evaluation, 1998. **4**(1): p. 37-51.
23. Gibbons, M. and L.G. Georghiou, *Evaluation of Research, A Selecetion of Current Practices*. 1987, Organisation for Economic Cooperation and Development Paris, France. p. 82.
24. OECD, *The OECD Science, Technology and Industry Scoreboard – 2009*. 2009, OECD publication. p. 146.
25. Luukkonen, T., *Additionality of EU framework programmes.* Research Policy, 2000. **29**(6): p. 711-724.
26. Buisseret, T.J., L.G. Georghiou, and H. Cameron, *What Difference Does It Make? Additionality in the Public Support of R&D in Large Firms.*

International Journal of Technology Management, 1995. **10**(4/5/6): p. 587-600.

27. PREST, et al., *Assessing the Socio-economic Impacts of the Framework Programme* L. Georghiou, J. Rigby, and H. Cameron, Editors. 2002, Policy Research in Engineering Science and Technology PREST, University of Manchester. p. 368
28. OECD, *Government R&D Funding and Company Behaviour - Measuring Behavioural Additionality*. 2006.
29. Aerts, K. and T. Schmidt, *Two for the price of one?: Additionality effects of R&D subsidies: A comparison between Flanders and Germany.* Research Policy, 2008. **37**(5): p. 806-822.
30. Jyrki, A.-Y., *Impact of Public R&D Financing on Private R&D - Does Financial Constraint Matter?* 2004, The Research Institute of the Finnish Economy.
31. Streicher, G., A. Schibany, and N. Gretzmacher, *Input Additionality Effects of R&D Subsidies in Austria* 2004, Institute of Technology and Regional Policy - Joanneum Research
32. Hyvärinen, J. and A.-M. Rautiainen, *Measuring additionality and systemic impacts of public research and development funding -- the case of TEKES, Finland.* Research Evaluation, 2007. **16**(3): p. 205-215.
33. Martin, F., *The economic impact of Canadian university R&D.* Research Policy, 1998. **27**(7): p. 677-687.
34. Odagiri, H. and H. Iwata, *The impact of R&D on productivity increase in Japanese manufacturing companies.* Research Policy, 1986. **15**(1): p. 13-19.
35. Noyons, E.C.M., M. Luwel, and H.F. Moed, *Assessment of Flemish R&D in the field of information technology: A bibliometric evaluation based on publication and patent data, combined with OECD research input statistics.* Research Policy, 1998. **27**(3): p. 285-300.
36. Hsu, F.-M., D.-J. Horng, and C.-C. Hsueh, *The effect of government-sponsored R&D programmes on additionality in recipient firms in Taiwan.* Technovation, 2009. **29**(3): p. 204-217.

37. Davenport, S., C. Grimes, and J. Davies, *Research collaboration and behavioural additionality: A New Zealand case study.* Technology Analysis & Strategic Management, 1998. **10**(1): p. 55 - 68.
38. Danila, N., *Strategic Evaluation and Selection of R&D Projects.* R&D Management, 1989. **19**(1): p. 47-62.
39. Kostoff, R.N., *Research requirements for research impact assessment.* Research Policy, 1995. **24**(6): p. 869-882.
40. Capron, H., *Economic Quantitative Methods for the Evaluation of the Impact of R&D Programmes. Astate of the Art*. 1992, European Community Commission: Brussels.
41. Evangelista, R., et al., *Nature and impact of innovation in manufacturing industry: some evidence from the Italian innovation survey.* Research Policy, 1997. **26**(4-5): p. 521-536.
42. Roessner, D., *Quantitative and qualitative methods and measures in the evaluation of research.* Research Evaluation, 2000. **9**: p. 125-132.
43. IPTS, J., *RTD Evaluation Toolbox - Assessing the Socio-Economic Impact of RTD-Policies* in *PTS Technical Report Series, EUR 20382 EN* 2001: Seville, Spain.
44. Bozeman, B. and J. Melkers, *Evaluating R&D Impacts: Methods and Practice*. 1993, Norwell, Massachusetts: Kluwer Academic Publishers.
45. Baba, Y., N. Shichijo, and S.R. Sedita, *How do collaborations with universities affect firms' innovative performance? The role of "Pasteur scientists" in the advanced materials field.* Research Policy, 2009. **38**(5): p. 756-764.
46. Grønhaug, K. and T. Fredriksen, *Governmental innovation support in Norway : Micro- and macro-level effects.* Research Policy, 1984. **13**(3): p. 165-173.
47. Mansfield, E. and L. Switzer, *The effects of R&D tax credits and allowances in Canada.* Research Policy, 1985. **14**(2): p. 97-107.
48. Sakakibara, M., *Evaluating government-sponsored R&D consortia in Japan: who benefits and how?* Research Policy, 1997. **26**(4-5): p. 447-473.

49. Larédo, P., *The networks promoted by the framework programme and the questions they raise about its formulation and implementation.* Research Policy, 1998. **27**(6): p. 589-598.
50. Yin, R., *Case Study Research*. 2nd ed. ed. 1994: Thousand Oaks.
51. Shadish, M., T. Cook, and L. Leviton, *Foundations of Program Evaluation*. 1991: Newbury Park. 286-301.
52. Eisenhardt, K.M., *Building Theories from Case Study Research.* Academy of Management Review, 1989. **14**(4): p. 532-550.
53. Bozeman, B. and G. Kingsley, *R&D Value Mapping: A New Approach to Case Study-Based Evaluation.* The Journal of Technology Transfer, 1997. **22**(1): p. 33.
54. Lang, G., *Measuring the returns of R&D--An empirical study of the German manufacturing sector over 45 years.* Research Policy, 2009. **38**(9): p. 1438-1445.
55. Cordes, J.J., *Tax incentives and R&D spending: A review of the evidence.* Research Policy, 1989. **18**(3): p. 119-133.
56. Del Monte, A. and E. Papagni, *R&D and the growth of firms: empirical analysis of a panel of Italian firms.* Research Policy, 2003. **32**(6): p. 1003-1014.
57. Justman, M. and E. Zuscovitch, *The Economic Impact of Subsidized Industrial R&D in Israel.* SSRN eLibrary.
58. Özçelik, E. and E. Taymaz, *Does innovativeness matter for international competitiveness in developing countries?: The case of Turkish manufacturing industries.* Research Policy, 2004. **33**(3): p. 409-424.
59. Boekholt, P., et al., *An International Comparative Study on Initiatives to Build, Develop and Support Competences*. 1998, Technopolis.
60. Newman, M.E.J., *The Structure of Scientific Collaboration Networks.*, in *Proceedings of the National Academy of Sciences*. 2001. p. 404-409.
61. Malerba, F., et al., *Evaluation of progress towards a European Research Area for Information Society Technologies*. 2006, CESPRI.

62. Defazio, D., A. Lockett, and M. Wright, *Funding incentives, collaborative dynamics and scientific productivity: Evidence from the EU framework program.* Research Policy, 2009. **38**(2): p. 293-305.
63. Stephan, P.E. and S.G. Levin, *Measures of scientific output and the age-productivity relationship*. Handbook of Quantitative Studies of Science and Technology, ed. A.F.J. VanRaan. 1988: North Holland: Elsevier Publications.
64. Moed, H.F. and F.T. Hesselink, *The publication output and impact of academic chemistry research in the Netherlands during the 1980s: bibliometric analyses and policy implications.* Research Policy, 1996. **25**(5): p. 819-836.
65. Nederhof, A.J. and A.F.J. van Raan, *A bibliometric analysis of six economics research groups: A comparison with peer review.* Research Policy, 1993. **22**(4): p. 353-368.
66. Koshland, D.E., *Peer Review of Peer Review.* Science and Public Policy, 1985. **288**: p. 1387.
67. Erkki, O., *Five-Year Assessment of the European Union Research Framework Programmes*. 2004, Luxembourg: Office for Official Publications of the European Communities
68. Joan, M., *FIVE-YEAR ASSESSMENT OF THE EUROPEAN UNION RESEARCH AND TECHNOLOGICAL DEVELOPMENT PROGRAMMES, 1995-1999*. 2000, European Commission.
69. Schibany, A., et al., *Evaluation of Austrian Participation in the 4th EU Framework Programme For Research, Technological Development and Demonstration* 2001.
70. Dengis, P., E. Dewallef, and V. Lories, *Flanders in the European Fourth Framework Programme for Research (1994-1998)*. 2001, Ministry of Flanders Science, Innovation and Media Department Science and Innovation Administration.
71. Vanecek, J., M. Fatun, and V. Albrecht, *Bibliometric evaluation of the FP-5 and FP-6 results in the Czech Republic.* Scientometrics.

72. Graversen, E.K. and K. Siune, *Danish research co-operation in EU: Extent, return and participation*. 2000, The Danish Institute for Studies in Research and Research Policy.
73. Uotila, M., et al., *Finnish Participation in the EU Fifth Framework Programme and Beyond*. 2004, VTT and TEKES.
74. Kuitunen, S., et al., *Finnsinthe EU 6th Framework Programme Evaluation of Participation and Networks*. 2008, TEKES.
75. Reger, G. and S. Kuhlmann, *European Technology Policy in Germany*. 1995, Physica-Verlag, Heidelberg.
76. Cassells, P., et al., *The 4th Framework Programme in Ireland*. 2001, Forfás.
77. Arnold, E., et al., *Impacts of EU Framework Programmes in Sweden* 2008, VINNOVA.
78. *Switzerland's Participation in the 6th European Research Framework Programme*. 2008, State Secretariat for Education and Research SER
79. *Switzerland's Participation in the 7th European Research Framework Programme, stocktaking report 2007–2008*. 2009, State Secretariat for Education and Research SER.
80. *Effects of Swiss participation in EU Research Framework Programmes*. 2010, State Secretariat for Education and Research SER.
81. Sørensen, W., et al., *Evaluation of Norway's participation in the European Union's 5th Framework Programme*. 2004, Norwegian Ministry of Trade and Industry.
82. Technopolis, *The Impact of the EU Framework Programmes in the UK*. 2004, Office of Science.
83. Commission, E., *The Sixth Framework Programme in brief*. 2002.
84. European Commission, *FP6 Final Review: Subscription, Implementation, Participation* 2008.
85. European Commission., *Information Society Technologies 2003-2004 Workprogramme*. 2003.
86. Chitu Okoli and Suzanne D. Pawlowski, *The Delphi method as a research tool: an example, design considerations and applications.* Information&Management, 2004. **42**: p. 15-29.

87. European Commission, *Guide to Financial Issues relating to FP7 Indirect Actions*. 2009.
88. Luukkonen, T., *The difficulties in assessing the impact of EU framework programmes.* Research Policy, 1998. **27**(6): p. 599-610.
89. TÜBİTAK AB Çerçeve Programları Ulusal Koordinasyon Ofisi, www.fp7.org.tr, last visited on 20 July 2010.
90. Community Research and Development Information Service, cordis.europa.eu, last visited on 15 July 2010
91. Community Research and Development Information Service, cordis.europa.eu, last visited on 15 July 2010

APPENDIX A

DELPHI SURVEY

DELPHI SURVEY	
Share 100 points among the below factors according to your priorities.	**Points**
1. Scientific and technological effects and outputs **2. Economic impacts and outputs** **3. Development of sector knowledge and collaborations** **4. Other Organizational Gains**	
Share 100 points among the below factors according to your priorities.	
1.1. New technological knowhow (new scientific knowledge) **1.2. Business output** **1.3. New skills developed** **1.4. Scientific output**	
Share 100 points among the below factors according to your priorities.	
1.1.1. New technology acquired from the project (learning or formal technology transfer) **1.1.2. New or substantially improved research methods or equipment** **1.1.3. New scientific knowledge**	
Share 100 points among the below factors according to your priorities.	
1.2.1. Prototypes **1.2.2. Software** **1.2.3. Norms and/or standards**	
Share 100 points among the below factors according to your priorities.	
1.1.1. New Managerial Skills **1.1.2. New Technical and technological skills** **1.1.3. New Marketing skills**	
Share 100 points among the below factors according to your priorities.	

Appendix A continued

1.4.1. # of publications derived from the project **1.4.2. # Other forms of dissemination (organized workshops, conferences...)** **1.4.3. # of patents or other forms of IPR rights**	

Share 100 points among the below factors according to your priorities.

2.1. New and/or improved products, process or services **2.2. Change in Productivity** **2.3. Competitive Position** **2.4. Access to new financial resources**	

Share 100 points among the below factors according to your priorities.

2.1.1. New product formation **2.1.2. Qualitative improvements in products** **2.1.3. Adding new feature into existing product**	

Share 100 points among the below factors according to your priorities.

2.2.1. Increase of productivity **2.2.2. New or substantially improved production processes**	

Share 100 points among the below factors according to your priorities.

2.3.1. Access to new domestic markets **2.3.2. Access to new international markets** **2.3.3. Increase in sales** **2.3.4. Increase in exports**	

Share 100 points among the below factors according to your priorities.

2.4.1. Research funding **2.4.2. Financial input from commercialization of the research results**	

Share 100 points among the below factors according to your priorities.

3.1. New knowledge on existing future markets and technologies **3.2. New partnerships (international cooperation)**	

Share 100 points among the below factors according to your priorities.

Appendix A continued

3.1.1. Monitoring scientific & Technological development in the field **3.1.2. Monitoring Competitors (attended fairs, memberships...)**	

Share 100 points among the below factors according to your priorities.

3.1.1.1. Membership to European Technology Platforms and other related umbrella organizations **3.1.1.2. Memberships to ICT related nongovernmental organizations**	

Share 100 points among the below factors according to your priorities.

3.2.1. New contacts **3.2.2. Deepening of collaboration** **3.2.3. Sharing risk and cost of R&D** **3.2.4. Future research partnerships**	

Share 100 points among the below factors according to your priorities.

3.2.1.1. National **3.2.1.2. International**	

Share 100 points among the below factors according to your priorities.

4.1. Human resources **4.2. Infrastructure Development** **4.3. Increased organisational prestige** **4.4. Learning about EU R&D programmes** **4.5. Increasing organizational R&D awareness**	

Share 100 points among the below factors according to your priorities.

4.1.1. Training of personal **4.1.2. Increase in post-graduate degree personal because of the project** **4.1.3. Job creation**	

Share 100 points among the below factors according to your priorities.

4.1.3.1. Managerial **4.1.3.2. Technological** **4.1.3.3. Support services**	

Appendix A continued

Share 100 points among the below factors according to your priorities.

4.2.1. Foundation of an R&D laboratory during the project **4.2.2. Foundation of an R&D laboratory for a specific research topic** **4.2.3. Purchase of equipment**	

Share 100 points among the below factors according to your priorities.

4.3.1. gaining prestige for the organization **4.3.2. added visibility for the organization**	

Share 100 points among the below factors according to your priorities.

4.4.1. Learning about EU funding opportunities **4.4.2. Learning about preparing project proposal** **4.4.3. Learning how to manage international R&D programmes**	

Share 100 points among the below factors according to your priorities.

4.4.2.1. National projects **4.4.2.2. International project**	

Share 100 points among the below factors according to your priorities.

4.5.1. Increase in R&D investment **4.5.2. Increased awareness about R&D studies** **4.5.3. Increase in the number of R&D personnel** **4.5.4. Establishment of a new R&D department**	

APPENDIX B

PARTICIPANT SURVEY

	Answer following regarding your FP6 IST field participation
Q1	**QUESTION 1 - Considering your project participation, what do you think about your achievement level in the below listed impacts and effects? (1-Totally disagree, 2-Disagree, 3-Neither agree nor disagree, 4-Agree, 5-Totally agree)**
A1	**We learned new technologies we have not used before.**
A2	**We transferred new technologies we have never used before.**
A3	**We produced or started to use new or substantially improved research methods or equipments we have never used before.**
A4	**We acquired new scientific knowledge.**
A5	**We produced a new prototype.**
A6	**We produced a new software.**
A7	**We produced a new standard/norm.**
A8	**We acquired new administrative skills.**
A9	**We acquired new technical and technological skills.**
A10	**We acquired new marketing skills.**
A11	**Throughout the project we published academic publications (journal paper, thesis, conference proceedings...).**
A12	**At the end of the project we acquired new intellectual property rights (patent, copyright etc.)**
B1	**We produced a new product.**
B2	**We produced more qualitative products.**
B3	**Project increased productivity of our organization.**
B4	**We produced new service or production processes.**

Appendix B continued	
B5	We reached new domestic markets.
B6	We reached new international markets.
B7	Project increased our sales.
B8	Project increased our export.
B9	We achieved new research funding.
B10	We earned financial income from commercialization of the research results.
C1	Project increased our knowledge about the sector.
C2	Project increased the number of our sectoral collaborations.
C3	As a result of the project we are following European Technology Platforms and other research networks better.
C4	By the help of the project we are monitoring our competitors better.
C5	We achieved new contacts.
C6	Project enhanced our collaboration with the partners we have already been collaborating with.
C7	Project partnerships decreased the risk of our R&D expenses.
C8	Project increased our participation in national R&D projects like ARDEB, TEYDEB, TTGV etc.
C9	By the help of the project, we set new relationships which will enable us to participate in international R&D programmes like FP and EUREKA
D1	Project personnel acquired new knowledge and skills.
D2	Number of post graduate degree personals in our organization has increased.
D3	New management positions were opened.
D4	New researcher employment positions were opened.
D5	New support service positions were opened.
D6	We set a new test and measurement labratory.
D7	We set a new research laboratory.

Appendix B continued	
D8	We have been informed about the research funding opportunities in EU.
D9	We achieved new knowledge and experience on managing international R&D projects.
D10	We had new skills in national project proposal preparation.
D11	We had new skills in international project proposal preparation.
D12	Our organization gained prestige.
D13	Our organization's recognition in foreign research networks has increased.
D14	Project increased our total R&D spending.
D15	R&D awareness in our organization has increased.
D16	Project increased the number of our R&D personal.
Q2	QUESTION 2 - How do you define your project activity? [1-Research; 2-Demonstration; 3-Both]
Q3	QUESTION 3 - What was your role in the project? [1-Coordinator; 2-WP leader; 3-Task Leader; 4-None]
Q4	QUESTION 4 - What would you do if your project was not funded? [1-We would not have gone with the project; 2-We would not have gone with the project but we would have done another one instead; 3- We would have done the project with different funding; 4-We would have done with a reduced scope; 5-We would have done over a longer timeframe; 6-We would have done with smaller number of partners]
Q5	QUESTION 5- Throughout the project ....
Q5.1	Have you employed a TÜBİTAK scholarship holder? [1-yes; 2-no]
Q5.2	Have you bought new equipment? [1-yes; 2-no]
Q5.3	Have you set a new R&D department? [1-yes; 2-no]
Q6	QUESTION 6- Throughout the project ....
Q6.1	Have you set collaborations beyond EU (e.g. U.S., South Korea, Canada) using the knowhow you acquired from the project?

Appendix B continued	
Q6.2	**Have you set national collaborations using the knowhow you acquired from the project? [1-yes; 2-no]**
Q7	**QUESTION 7- Throughout the project ....**
Q7.1	**Did you take part in an ARDEB project in the similar topic with your FP project? [1-yes; 2-no]**
Q7.2	**Did you take part in a TEYDEB project in the similar topic with your FP project? [1-yes; 2-no]**
Q7.3	**Did you take part in a TTGV project in the similar topic with your FP project? [1-yes; 2-no]**
Q7.4	**Did you take part in an SANTEZ project in the similar topic with your FP project? [1-yes; 2-no]**
Q8	**Did you make any other project applications with the same partners in the consortium? [1-yes; 2-no]**
Q9	**What is the percentage increase of your sales you experienced because of the project?**
Q10	**What is the percentage increase of your income from sales you experienced because of the project?**
Q11	**What is the percentage increase of your export you experienced because of the project?**
Q12	**What is the percentage increase of your patent, expertise (knowhow) income you experienced because of the project?**
Q13	**How many new products you produced throughout the project?**
Q14	**How many software you produced throughout the project?**
Q15	**How many prototypes you produce throughout the project?**
Q16	**How many standard/norm you developed throughout the project?**
Q17	**How many academic publications (journal paper, thesis, conference proceedings...) you published throughout the project?**

Appendix B continued

Q18	**What are the research networks you have become a member after your project participation?**
Q19	**How many post-graduate personal joined to your team after the project?**
Q20	**Please indicate your comments if any..**

APPENDIX C

CORRELATIONS

Table C1. Correlations between scientific and technological impact factors

Correlations between scientific and technological impact factors												
Kendall's tau_b	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
A1	1,00	0,58	0,48	0,51	0,44	0,55	0,44	0,52	0,64	0,49	0,46	0,09
A2	0,58	1,00	0,56	0,42	0,47	0,38	0,35	0,42	0,45	0,59	0,36	0,21
A3	0,48	0,56	1,00	0,61	0,33	0,68	0,39	0,41	0,59	0,51	0,39	0,21
A4	0,51	0,42	0,61	1,00	0,35	0,66	0,38	0,53	0,69	0,54	0,38	0,27
A5	0,44	0,47	0,33	0,35	1,00	0,40	0,53	0,47	0,37	0,48	0,23	0,45
A6	0,55	0,38	0,68	0,66	0,40	1,00	0,47	0,35	0,70	0,32	0,40	0,23
A7	0,44	0,35	0,39	0,38	0,53	0,47	1,00	0,31	0,44	0,41	0,14	0,19
A8	0,52	0,42	0,41	0,53	0,47	0,35	0,31	1,00	0,53	0,58	0,10	0,21
A9	0,64	0,45	0,59	0,69	0,37	0,70	0,44	0,53	1,00	0,46	0,32	0,08
A10	0,49	0,59	0,51	0,54	0,48	0,32	0,41	0,58	0,46	1,00	0,24	0,34
A11	0,46	0,36	0,39	0,38	0,23	0,40	0,14	0,10	0,32	0,24	1,00	0,32
A12	0,09	0,21	0,21	0,27	0,45	0,23	0,19	0,21	0,08	0,34	0,32	1,00

Table C2. Correlations between economic impact factors

Correlations between economic impact factors										
Kendall's tau_b	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
B1	1	0,73	0,51	0,635	0,652	0,643	0,728	0,657	0,176203	0,737
B2	0,73	1	0,353	0,629	0,544	0,574	0,673	0,634	0,170115	0,613
B3	0,51	0,353	1	0,571	0,423	0,461	0,533	0,451	0,406	0,445
B4	0,635	0,629	0,571	1	0,615	0,627	0,752	0,705	0,334	0,662
B5	0,652	0,544	0,423	0,615	1	0,769	0,786	0,755	0,285	0,786
B6	0,643	0,574	0,461	0,627	0,769	1	0,836	0,791	0,264445	0,631
B7	0,728	0,673	0,533	0,752	0,786	0,836	1	0,887	0,346	0,765
B8	0,657	0,634	0,451	0,705	0,755	0,791	0,887	1	0,281437	0,808
B9	0,176203	0,170115	0,406	0,334	0,285	0,264445	0,346	0,281437	1	0,283114
B10	0,737	0,613	0,445	0,662	0,786	0,631	0,765	0,808	0,283114	1

Table C3. Correlations between impacts on collaborations and sectoral knowledge

Correlatrions between impacts on collaborations and sectoral knowledge									
Kendall's tau_b	C1	C2	C3	C4	C5	C6	C7	C8	C9
C1	1,00	0,17	0,37	0,48	0,26	0,25	0,05	0,25	0,16
C2	0,17	1,00	0,54	0,42	0,59	0,44	0,01	0,30	0,54
C3	0,37	0,54	1,00	0,62	0,63	0,43	0,28	0,29	0,61
C4	0,48	0,42	0,62	1,00	0,60	0,54	0,27	0,38	0,38
C5	0,26	0,59	0,63	0,60	1,00	0,52	0,25	0,36	0,64
C6	0,25	0,44	0,43	0,54	0,52	1,00	0,16	0,16	0,38
C7	0,05	0,01	0,28	0,27	0,25	0,16	1,00	0,46	0,20
C8	0,25	0,30	0,29	0,38	0,36	0,16	0,46	1,00	0,42

Table C4. Correlations between other institutional impacts

Correlations between other institutional impacts																
Kendall's tau_b	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16
D1	1,00	0,26	0,51	0,31	0,33	0,27	0,17	0,62	0,59	0,57	0,49	0,58	0,53	0,22	0,42	0,24
D2	0,26	1,00	0,30	0,58	0,06	0,25	0,25	0,39	0,44	0,41	0,30	0,37	0,38	0,45	0,43	0,60
D3	0,51	0,30	1,00	0,61	0,59	0,53	0,21	0,32	0,33	0,38	0,42	0,40	0,36	0,24	0,34	0,38
D4	0,31	0,58	0,61	1,00	0,47	0,44	0,43	0,36	0,42	0,29	0,35	0,33	0,31	0,37	0,34	0,59
D5	0,33	0,06	0,59	0,47	1,00	0,56	0,40	0,03	0,17	0,08	0,15	0,18	0,18	-0,14	-0,02	0,09
D6	0,27	0,25	0,53	0,44	0,56	1,00	0,44	0,01	-0,02	0,31	0,11	0,25	0,28	0,11	0,26	0,33
D7	0,17	0,25	0,21	0,43	0,40	0,44	1,00	0,28	0,15	-0,02	0,19	0,24	0,28	-0,16	0,00	0,17
D8	0,62	0,39	0,32	0,36	0,03	0,01	0,28	1,00	0,65	0,46	0,63	0,58	0,54	0,34	0,45	0,39
D9	0,59	0,44	0,33	0,42	0,17	-0,02	0,15	0,65	1,00	0,37	0,67	0,56	0,52	0,37	0,30	0,36
D10	0,57	0,41	0,38	0,29	0,08	0,31	-0,02	0,46	0,37	1,00	0,48	0,59	0,55	0,38	0,56	0,52
D11	0,49	0,30	0,42	0,35	0,15	0,11	0,19	0,63	0,67	0,48	1,00	0,65	0,60	0,36	0,52	0,44
D12	0,58	0,37	0,40	0,33	0,18	0,25	0,24	0,58	0,56	0,59	0,65	1,00	0,98	0,20	0,52	0,33
D13	0,53	0,38	0,36	0,31	0,18	0,28	0,28	0,54	0,52	0,55	0,60	0,98	1,00	0,16	0,50	0,33
D14	0,22	0,45	0,24	0,37	-0,14	0,11	-0,16	0,34	0,37	0,38	0,36	0,20	0,16	1,00	0,60	0,64
D15	0,42	0,43	0,34	0,34	-0,02	0,26	0,00	0,45	0,30	0,56	0,52	0,52	0,50	0,60	1,00	0,57
D16	0,24	0,60	0,38	0,59	0,09	0,33	0,17	0,39	0,36	0,52	0,44	0,33	0,33	0,64	0,57	1,00

APPENDIX D

LIST of SURVEY PARTICIPANTS

Table D.1 List of Survey Participants

Project	Partner organization	Status of the organization
CoVES	BALKAN Makina	SME
3DTV	BİLKENT University	University
e-PhotonONe, e-PhotonONe+	BİLKENT University	University
e-PhotonONE+	BİLKENT University	University
MUSCLE	BİLKENT University	University
NEWCOM	BİLKENT University	University
PHOREMOST	BİLKENT University	University
ABILITIES	INNOVA	SME
MEDSI, SATINE	INTRO Solutions	SME
MEDSI, SATINE	INTRO Solutions	SME
NEWCOM	IŞIK University	University
GENESIS	BOYTAŞ	Big Industrial Organization
3DTV	KOÇ University	University
NEMO	KOÇ University	University
PHOREMOST	KOÇ University	University
3DTV	Middle East Technical University	University
ABILITIES	Middle East Technical University	SME
ARTEMIS	Middle East Technical University	University

Table D.1 Continued		
ICLASS	**Middle East Technical University**	**University**
MACS	**Middle East Technical University**	**University**
SAPHIRE	**Middle East Technical University**	**University**
SATINE	**Middle East Technical University**	**University**
Net-WMS	**Mind2biz**	**SME**
wearIT@work	**MOBİLERA**	**SME**
3DTV	**MOMENTUM**	**SME**
OI	**PHONOCLICK**	**SME**
Open_TC	**PORTAKAL TEKNOLOJİ**	**SME**
ICLASS	**RTB**	**SME**
GeoPKDD	**SABANCI University**	**University**
NEMO	**SABANCI University**	**University**
IWARD	**SAKARYA University**	**University**
ICLASS	**SEBİT**	**SME**
Guardians	**TOBB ETU**	**University**
Open_TC	**TÜBİTAK UEKAE**	**Research Centre**