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RESEARCH AND DEVELOPMENT POLICY IN TURKEY IN THE CONTEXT OF EU ACCESSION AND THE LISBON STRATEGY

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ONAY SAYFASI

Enstitümüz AB İktisadı Anabilim Dalı Yüksek Lisans öğrencisi Yasin UZUN'un ***"RESEARCH AND DEVELOPMENT POLICY IN TURKEY IN THE CONTEXT OF EU ACCESSION AND THE LISBON STRATEGY"*** konulu tez çalışması 23/12/2011. tarihinde yapılan tez savunma sınavında aşağıda isimleri yazılı jüri üyeleri tarafından oybirliği / ~~oyçokluğu~~ ile başarılı / ~~başarısız~~ bulunmuştur.

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Onay
Prof. Dr. Muzaffer DARTAN
Müdür

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"Like Alice and the Red Queen, the developed region must keep running to stay in the same place."[1]

Paul Krugman

[1] Krugman, Paul, (1979), "A Model of Innovation, Technology Transfer, and the World Distribution of Income", **The Journal of Political Economy**, Vol. 87, No. 2, p.262.

ABSTRACT

This study aims to answer two questions regarding the suitability of Lisbon Strategy for the economic development of Turkey based on technology investments and increased international competitiveness. The first question asks how successful is Lisbon Strategy itself for governing the process and supporting economic development of EU member states in the last decade. In order to answer this question, the performance of the EU member states in reaching the Research and Development (hereinafter referred to as R&D) related targets are measured both overall and individually. Regarding the overall performance, the striking conclusion is the clear transition to multi-polar world in terms of R&D efforts and output. The Asian countries namely China, Korea, and to some extent Japan, have been experiencing a remarkable progress. On the other side, EU and US are losing ground in main indicators. When the performance of individual countries are considered, the conclusion can be summarized as variety in terms of different indicators. Although, all member states are pursuing the same goals under the same strategy, the results show different trends which is, indeed, interpreted in many studies as the 'Mixed Lisbon Picture'. The second question asks how meaningful the Lisbon targets are for increasing competitiveness. In order to answer this question, regression analysis is applied and the statistical significance and the degree of impact of the variables are tested empirically. Three hypothesis are established and tested in empirical study. First hypothesis tests whether overall R&D expenditures has an influence on international competitiveness or not. Based on the increasing focus on private sector participation in R&D activities in the World, the second hypothesis tests whether business sector R&D expenditures are more effective than government or higher education expenditures. Considering the literature on the time needed for transformation process of knowledge to commercial products, third hypothesis asks if lagged R&D expenditures have an influence on international competitiveness. Empirical findings shows that despite the failure of Lisbon Strategy as a policy, the R&D expenditures that are targeted in the Strategy have a statistically significant impact on international competitiveness which is represented by high technology exports share of Turkey in OECD in the models. Also, the sectoral analysis proves that R&D expenditures of private sector has stronger relation with export performance than government or higher education expenditures.

ÖZET

Bu çalışmanın amacı Lizbon Stratejisinin Türkiye'nin teknoloji yatırımları ve artan uluslararası rekabet gücüne dayalı ekonomik kalkınma amacına ulaşması için uygunluğunu ölçmek amacıyla sorulmuş iki soruya cevap bulmaktır. İlk soru, Lizbon Stratejisinin son 10 yılda AB üyesi ülkelerin ekonomik kalkınmalarına katkıda bulunma ve süreci yönetme konusunda ne kadar başarılı olduğunu sormaktadır. Söz konusu soruyu cevaplamak amacıyla AB üyesi ülkelerin Lizbon Stratejisinde konulan Ar&Ge hedeflerine ulaşmada gösterdikleri performans ülke bazında ve AB genelinde incelenmiştir. AB'nin genel performansı incelendiğinde ortaya çıkan en belirgin sonuç, dünyada Ar&Ge harcamaları ve sonuçları bakımından "iki kutuplu" bir dünyaya doğru gidildiğidir. Çin ve Kore gibi Asya ülkeleri yüksek performans gösterirken, AB ve ABD birçok alanda yerini kaybetmektedir. Üye ülkelerin performansları ise çok çeşitlilik göstermektedir. Tüm üye devletler tek bir Stratejiyi takip ettiği halde performansları büyük farklılıklar göstermektedir ki bu durum birçok çalışmada "Karışık Lizbon Fotoğrafı" olarak adlandırılan sonuçtur. Bu çalışmadaki ikinci soru, Lizbon'da koyulan hedeflerin uluslararası rekabet gücünü artırmak açısından ne kadar anlamlı olduğunu sormaktadır. Bu soruya cevap vermek amacıyla regresyon analizi yapılmıştır. Analizde 3 hipotez kurulmuştur. İlk hipotez toplam Ar&Ge harcamalarının uluslararası rekabet gücüne etkisi olup olmadığını test etmektedir. İkinci hipotez ise dünyada özel sektörün Ar&Ge aktivitelerine katılımının artırılmasına yönelik politikaları dikkate alarak özel sector Ar&Ge harcamalarının devlet ve üniversite Ar&Ge harcamalarından daha etkin olup olmadığını sorgulamaktadır. Son hipotez ise, literatürde Ar&Ge harcamalarının sonucunda ortaya çıkan bilginin ticari ürünlere dönüşmesi için gerekli zamana ilişkin literatürde yer alan çalışmaları dikkate alarak, geçmiş dönem Ar&Ge harcamaların ihracat performansına etkisini test etmektedir. Regresyon analizi sonuçları Lizbon Stratejisinin politika olarak başarısızlığına rağmen, Stratejide koyulan Ar&Ge hedeflerinin, modelde Türkiye'nin yüksek teknolojisi ihracatının OECD içindeki payı ile temsil edilen, uluslararası rekabet gücü üzerinde istatistiksel olarak anlamlı bir etkisi olduğunu göstermektedir. Ayrıca, sektörel analiz özel sektör Ar&Ge harcamalarının ihracat performansı üzerinde devlet ve üniversite harcamalarından daha güçlü bir etkisi olduğunu göstermektedir.

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LIST OF ABBREVIATIONS

AAGR	Average Annual Growth Rate
BEPG	Broad Economic Policy Guidelines
BERD	Business Expenditure on R&D
BTYK	Supreme Council for Science and Technology
CEEC	The Central and Eastern European Countries
CEO	Chief Executive Officer
DPT	State Planning Organisation
DTM	Undersecretariat of the Prime Ministry for Foreign Trade
EG	Employment Guidelines
EMU	European Monetary Union
EP	European Parliament
ERA	European Research Area
ETP	European Technology Platforms
EU	European Union
EU-15	European Union (15 countries)
EU-25	European Union (25 countries)
Eurostat	Statistical Office of the European Communities
FDI	Foreign Direct Investment
FP	Framework Programme
FTA	Free Trade Agreements
FTE	Full-time Equivalence
GBAORD	Government budget appropriations or outlays on R&D
GCR	Global Competitiveness Report
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on Research and Development
GFCC	Global Federation of Competitiveness Councils
GITES	Input Supply Strategy
HERD	Higher Education Expenditure on R&D
ICT	Information and Communication Technologies
IG	Integrated Guidelines
IMD	International Institute for Management Development
IT	Information Technologies
KOSGEB	Small and Medium-sized Industry Development Organisation
MSTI	OECD main science and technology indicators
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
OMC	Open Method of Coordination
PCT	The Patent Cooperation Treaty
RCA	Revealed Comparative Advantage
RTB	Relative Trade Balance
R&D	Research and Development
SITC	Standard International Trade Classification

SME	Small and Medium-sized Industry
TDZ	Technology Development Zones
TOBB	Union of Chambers and Commodity Exchanges of Turkey
TTGV	Technology Development Foundation of Turkey
TUBİTAK	The Scientific and Technological Research Council of Turkey
UIL	University-Industry Linkage
ULC	Unit Labor Cost
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNSTATS	United Nations Statistics Division
USAMP	Industry Joint Research Centers Program
VAT	Value Added Tax
WEF	World Economic Forum

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

With thestart of 1990s, the nature of economic growth has begun to change especially with rise of the dot.com and telecommunications sectors particularly in US. The information and communication technologies united with the flexible labor markets, macroeconomic stability and competitive product markets provided very significant advantage to some countries. In the second half of the 1990s, the number of people who came to the conclusion that "*productivity was underestimated and inflation overestimated*" has increased. The economic impact of R&D and increased productivity found more supporters in economic literature and politicians. The experiences of Australia, Finland, Ireland and US showed the way to others while Alan Greenspan were calling this new economy as another industrial revolution. EU institutionsbegan to focus more on the new emerging economy of innovation, which is reflected in the EU acquis in 1990s, as a result of the opening gap with particularly with USA in main macroeconomic conditions. These developments prepared the road to Lisbon Strategy which is announced as the main tool to make Europe "*the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion*"[1] Although, the ambitious objectives set in 2000 have not met, Lisbon Strategy is still on the table (with a different name as Europe 2020) for many EU member states and the candidate countries such as Turkey.

Acceptance of technology as a factor of growth by the neo-classical approach is mostly known by Robert Solow's article "A Contribution to the Theory of Economic Growth". Paul Romer in 1990, considered technology as an endogenous factor which is involved in the main mechanisms of economy and explained the interaction of R&D sector with other sectors in the economy. Similarlary, theories focusing on international trade began to evaluate the role that technology plays as a factor of competition. In 1961, Michael Vivian Posner established as two country model with an innovative

[1] European Council, (2000),**Lisbon European Council 23 and 24 March 2000 Presidency Conclusions**, p.2. http://www.europarl.europa.eu/summits/lis1_en.htm#a (21.11.2011)

North and imitating South concluding that difference between the two countries is based on the technological gap and the learning period for imitating the innovations which leads to the fact that the comparative advantage can continue according to these two variables. Paul Krugman is another supporter of North-South Trade Theories. Just like M. V. Posner, he stated that continuty of the difference between North and South depends on the rents from their monopoly of newly developed products. He summarized this situation by refering to Alice in Wonderland as *"Like Alice and the Red Queen, the developed region must keep running to stay in the same place."*[2]

Just like EU, Turkeyis trying to overcome its chronic economic problems by succeeding sustainable economic growth based on producing high valued added products, closing continuous trade deficit and creating sufficient employment according to the formal documents and the tendencies in general business environment. Considering the fact that EU membership is the so called primary objective for Turkey and the Lisbon Strategy is the main economic policy document with the aim of being a competitive economy based on technology, the performance of Lisbon Strategy and the effectiveness of its targets should be measured in order to analyze the potential of Lisbon Strategy as a model for increasing competitiveness of Turkey.

This study aims to answer two questions regarding the suitability of Lisbon Strategy for the economic development of Turkey based on technology and increased international competitiveness. The first question asks how successful Lisbon Strategy itself for supporting the economic development of EU member states. In order to answer this question, the performance of the EU member states in reaching the R&D targets since 2000 are measured by emphasizing the individual performance of emerging member states, having similar economic structures with Turkey, beside the overall performance. The second question asks how meaningful the R&D targets mentioned in the Lisbon Strategy are for increasing international competitiveness. In order to answer this question, regression analysis is applied and the statistical significance and the degree of impact of the indicators are tested empirically. Considering the frequently used indicators of international competitiveness, high

[2] Krugman, Paul, (1979), p.262.

technology exports share of Turkey in OECD is chosen to represent international competitiveness. Three hypothesis are established and tested in empirical study. First hypothesis tests whether overall R&D expenditures has an influence on international competitivess or not. Based on the increasing focus on private sector participation in R&D activities in the World, the second hypothesis tests whether business sector R&D expenditures are more effective than government or higher education expenditures. Considering the literature on the time needed for transformation process of knowledge to commercial products, third hypothesis asks if lagged R&D expenditures have an influence on international competitiveness.While answering these questions, first, the concept of research and development (R&D) and competitiveness are examined. Secondly, R&D policies in Turkey and main instruments and objectives of the Lisbon Strategy are summarized.

The thesis is organized as follows: in Chapter 1, first,research and development(R&D) definition and sectoral classification according to the Frascati Manual, which is referred by many international organizations, is explained. Second, the most common competitiveness definitions and indicators are summarized and the concept of technology in competitiveness definitions is observed. In Chapter 2, R&D policies in Turkey are mentioned from historical and EU membership perspectives by summarizing the developments in five year development plans, national science and technology policy in Turkey and the progress reports of EU. Chapter 3 explainsthe macroeconomic conditions in 1990s that lead the way to Lisbon Strategy and governance mechanisms and main objectives set in Lisbon Strategy including the targets, institutions, initiatives etc. In Chapter 4 and Chapter 5, the main questions of the study are addressed. Chapter 4benchmarks the overall and individual performance of EU member states in reaching the Lisbon targets while comparing the performance of main rivals of EU. In Chapter 5, first, the recent international trade structure and related policies in Turkey are mentioned. Second, the suitability of the targets mentioned in the Lisbon Strategy for Turkey is tested by measuring the impact these variables on export performance of Turkey by applying an econometric analysis.

CHAPTER 1: R&D AND COMPETITIVENESS

1.1 RESEARCH AND DEVELOPMENT

1.1.1. Definition

In June 1963, the OECD member states gathered at the Villa Falcioneri in Frascati, Italy with experts on research and development. The concluding document was the first official version of the Proposed Standard Practice for Surveys of Research and Development which is known as 'Frascati Manual'. The most recent publication of the Manual is the sixth edition published in 2002. International organizations such as OECD, UNESCO, European Union and various regional organizationshave been frequently used the manual in their initiatives which transformed it to a standard for worldwide surveys.[3]Since the basic indicators applied for benchmarkLisbon in this study[4]used the definitions and classifications of the Frascati Manual, the concepts related with R&D is explained by referencing the Manual.

Before measuring the country performance, the concepts should be cleared in order to understand what is tried to be succeeded. The definition of R&D and sectoral classification are mentioned here.

According to the Manual, Research and Experimental Development (R&D) covers"*creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications."*[5]The definition, indeed, explains the main criteria to be included in R&D. What makes an activity R&D is the systematic effort and the innovation that adds something new to the stock of knowledge.

R&D is composed of three main activities: Basic Research, Applied Research and Experimental Development. Basic Research is defined as *experimental or*

[3]OECD, (2002),**Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development**, p.2. http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/kilavuzlar/Frascati.pdf (21.11.2011)
[4] The following studies, which are referenced in this study, apply the definitions of the Manual: "Towards a European Research Area Science, Technology and Innovation: Key Figures 2007";"A More Research-Intensive and Integrated European Research Area: Science, Technology and Competitiveness Key Figures Report 2008/2009" and "Science, Technology and Industry Scoreboard 2007 Innovation and Performance in the Global Economy"
[5]OECD, (2002), p.30.

*theoretical work undertaken*to create knowledge *without any particular application or use*.The results of basic research is generally published in scientific journals and not sold.[6]The difference of Applied Research is the aim towards a specific practical objective.The results of applied research are generally patented. Experimental research uses the existing knowledge occurred by practical experience for *producing new materials, products, installing new processes, systems and services.*[7]

1.1.2. Sectoral Classification

In order to deepen the analysis on R&D activities, sector classification is applied. By doing so,the role of funding and performing entities is displayed in more detail and making policy implications for different parties in the economy become possible.

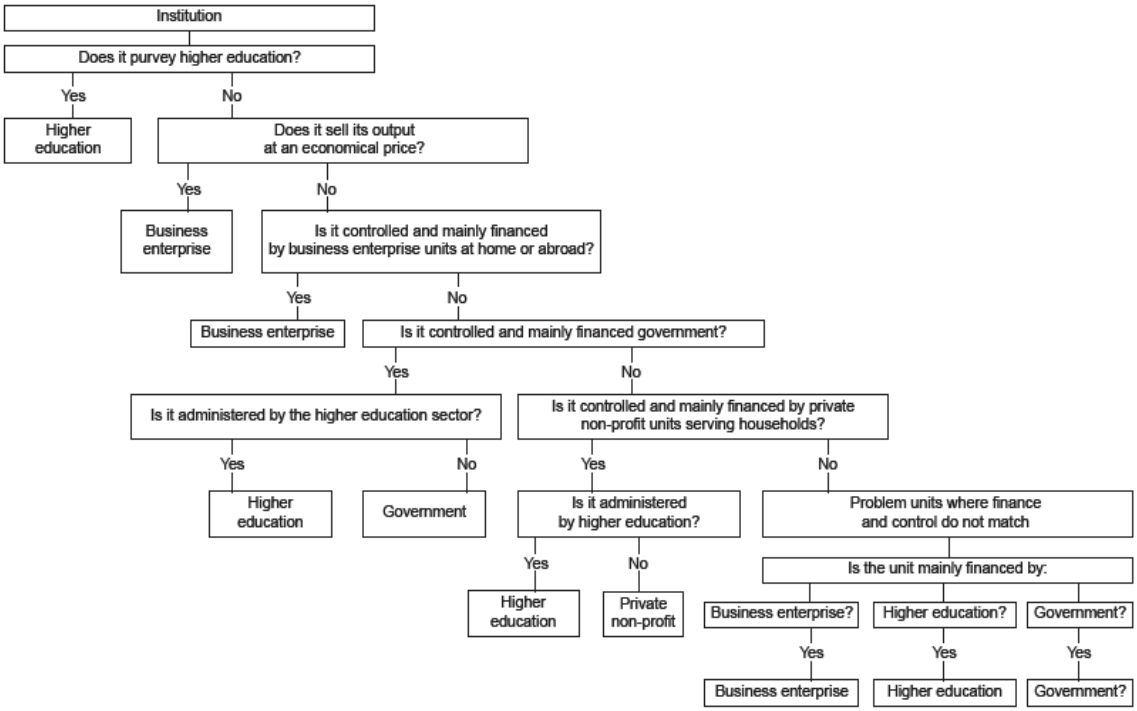
The Manual classifies R&D activities under four main sectors namely government, higher education, business enterprise and abroad. Figure 1.1 summarizes the criteria of sectoral classification by displaying the main questions in a decision tree. According to the figure, the activities that include selling its output at an economic price, which are controlled and financed by business sector, are assumed to be under business enterprise sector. On the other hand, R&D activities that are both controlled and administered by government or financed by government although the control blur, these activities belongs to government. When the activities are financed and controlled by government or private sector but administered by higher education, these activities are evaluated under higher education sector.

Business enterprise sector includes "*all firms, organizations and institutions whose primary activity is the market production of goods or services for sale to the general public at an economically significant price.* Business sector is composed of private companies and public enterprises which are involved in market production of products that are produced and sold by private sector. Also private non-profit organizations such as "*research institutes, clinics, hospitals, medicalpractitioners in*

[6]OECD, (2002), p.77.
[7]OECD, (2002), pp.78-79.

private, fee-paying practices" etc. can be engaged in R&D activities under business enterprise sector.[8]

Figure 1.1: Sectoral Classification Decision Tree



Source: OECD,(2002), p.55.

According to the Manual, government sector includes "*all departments, offices and other bodies which furnish, butnormally do not sell to the community, those commonservices, other than higher education… as well as thosethat administer the state and the economic and social policy ofthe community."*Also non-profit institutions financed by government and administered by higher education are also included in government sector. The "control" includes the ability to determine the program and the management. In the situations where the control is flu, the financer is assumed to be controlling sector.[9]

"All universities, colleges *of technology and other institutions of post-secondary education, whatever their source of finance or legal status"*are, included in

[8]OECD, (2002),p.56.
[9]OECD, (2002),p.63.

higher education sector. Indeed, the classification of research institutions is based on the purpose of research.

All institutions and individuals located outside the country, except different vehicles such as satellites, ships etc. and operated by domestic bodies and also all international organizations operating in the country are classified as abroad according to the Manual.[10]

1.2 COMPETITIVENESS

1.2.1. Different Aspects and Methodological Difficulties

Before arguing definition and suitable indicators of competitiveness, a basic seperation should be noted. In the literature, there are studies analysing "competitiveness" (or as it is used in some studies "competitive advantage") and "comparative advantage". Although, these concepts seem similar, they are substantially different. Comparative Advantage is presented by David Ricardo in his "Principles of Political Economy and Taxation" in 1817. He states that if the opportunity cost of producing a good in terms of other goods is lower in home country than it is in other countries, home country has a comparative advantage in producing that good and trade between two countries can benefit both countries if each country exports the goods in which it has a comparative advantage.[11]

In 1919 a Swedish economist Eli Heckscher published the article "*The Effect of Foreign Trade on the Distribution of Income*" but it was not widely noticed until Bertil Ohlin wrote his famous book "*Interregional and International Trade*" in 1933. Ricardian Model assumes that labor is the only factor of production and comparative advantage is based on differences in labor productivity but in real world all factors of production including land, capital and mineral resources are important as labor. Heckscher-Ohlin Model Theory focuses on *differences in the relative abundance of factors of production in countries as the most important determinant of the difference in relative commodity prices and comparative advantage*. Heckscher-Ohlin Model

[10] OECD, (2002), p.68.
[11] Krugman, Paul and Obstfield, Maurice, (2005), **International Economics**, Seventh Edition, Pearson International Edition, p.26.

Theory, also referred as factor-endowment theory, states that countries should export the products which are produced by the cheap and rich factors and vice versa.It can be said that Heckscher-Ohlin Model (Theory) explains the how comparative advantage occurs in more detail.[12]

As some basic assumptions of classical trade theories such as perfect competition and constant returns to scale are challenged, *new trade theories* occured. Constant returns to trade states that if the inputs of the industry were doubled, the output would also be doubled but in practice, increasing returns are valid so that the production becomes more efficient as scale gets larger. The reflection of increasing returns in international trade is that each country specializes in limited number of products that it produces in larger amounts more efficiently. The imperfect competition, on the other hand, challenged the assumption that there are many sellers in the market and they are price-takers. Since 1980s the monopolistic competition, which is a type of imperfect competition, is widely applied in international trade models. Monopolistic competition assumes that each firm can differentiate its products from its rivals and can behave like a monopoly in differentiated products. The increasing share of intra-industry trade in the world supports the importance of monopolistic competition in international trade. For example, the automobile industry in Europe shows the characateristics of a monopolistic competition where there are a number of major producers producing differentiated but ompeting automobiles.[13]

These developments in economic models brought into economic literature the term "competitiveness" which is, indeed, more difficult to define because it is theoretically a vague concept than comparative advantage. Competitiveness is defined for firms and nations by focusing on different factors. Although, factors that affect comparative advantage such as infrastructure, resource endowment etc. are relatively static, competitiveness is determined by a wider list of factors and policies of governments. Our purpose is not to refute the value of comparative advantage and to deny theoretical foundations of this theory in this study, but to emphasise the role of research and development in competitiveness.

[12]Salvatore, Dominic, (2005), **Introduction to International Economics**, Wiley&Sons, First Edition, pp.82-83.
[13] Krugman, Paul and Obstfield, Maurice, (2005), pp. 110-116

In order to measure competitiveness, the first thing to do should be to accept that there are so many and different aspects and indicators to measure it. One point is that competitiveness is measured for *firms, industrial sectors, target regions, nations* and also *supranational entities.* Using the same indicators of competitiveness both for a firm and a country will be over-simplifiying the concept and ignoring the differences of objectives and the nature of the competition.[14] For example, main objectives of a firm and a country differs in the way that the firm's basic target is to survive in the market while for a country increasing the living standards is aimed and survival is not mentioned as a concern.[15]

Interpretation of a firm's competitiveness differs when it is done by considering the local market, national market or the world market. Paul Krugman argues that competitiveness is something mostly related with domestic factors in his article "Competitiveness: A Dangerous Obsession" and states as follows*:"... the growth rate of living standards essentially equals the growth rate of domestic productivity…national living standards are overwhelmingly determined by domestic factors rather than by some competition for world markets*."[16] His main argument is that the focus should be given to domestic mechanisms of the economy without trying to compare with other nations. The main risk mentioned in his study is the possibility that the perception of competitiveness would become an obsession that leads to trade wars and more protectionism which is totally opposite to the Ricardian trade model that states mutual gain from trade. It should be noted that this thesis does not support government intervention to disturb free trade under various trade policies which may lead nations to such trade wars. It is believed that possible gains from interventions are *limited*[17] and *unproductive ways of making income*.[18] While keeping these in mind, a comparison is still considered to be necessary to understand whether domestic productivity of the firms and related policies of governments that promotes private sector are good enough.

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[14] Krugman, Paul, (2001), "Competitiveness: A Dangerous Obsession", **Foreign Affairs**, Vol. 73, No.2, p.31.
[15]OECD, (1996), "Globalisation and Competitiveness: Relevant Indicators", **OECD Science,Technology and Industry Working Papers**, 1996/5, pp.19-20.http://www.oecd-ilibrary.org/docserver/download/fulltext/5lgsjhvj7nlw.pdf?expires=1305123009&id=id&accname=guest&checksum=6833F859B790265B157A5186E9111C8C(21.11.2011)
[16]Krugman, Paul, (2001), p.34.
[17]Krugman, Paul, (1987), "Is Free Trade Passé?", **Journal of Economic Perspectives**, p.143.
[18]Bhagwati, Jagdish, (1989), "Is Free Trade Passé After All?", **Political Economy and International Economics**, p.15.

Lester C. Thurow responds to Paul Krugman in his article arguing that productivity is affected by investments which is mainly determined by the rate of return. He proposes that the rate of return is higher in high value-added sectors and it is important to be more productive than others to be able compete in world markets. He explains the importance of government policies for funding education, skill, research and supporting important sectors such as aerospace, telecommunications, computers etc. as a counter argument to Paul Krugman's definition of government policies for gaining international competitiveness as an obsession.[19]

Although these points give some insights about the term competitiveness, in order to have a broad perspective and find a definition and indicator that can be applied in the context and aim of this study, most referred definitions and indicators for measurement will be given below.

1.2.2. Definitions and Indicators of Competitiveness

In order to have a common understanding of the term competitiveness, formal documents, studies and reports of European Union, OECD, "Global Competitiveness Report (GCR)" of World Economic Forum (WEF), "World Competitiveness Yearbook" of International Institute for Management Development (IMD), "2010 Global Competitiveness Principles" of Global Federation of Competitiveness Councils (GFCC), Council on Competitiveness in USA are examined.

In the Commission's 2010 Competitiveness Report, competitiveness is seperated into two as domestic and international competitiveness. Domestic competitiveness is defined as *the institutional and policy arrangements that create the conditions under which productivity can grow sustainably*while external competitiveness stated as *the ability to export goods and services in order to afford imports, and hence it will be summarized by world market shares, the share of exports in total exports.*[20] In another report, domestic competitiveness is measured by using *labour productivity* and *unit labour costs* while indicators such as *market share of the*

[19] Thurow, Lester, (1994), "Microchips, Not Potato Chips", **Foreign Affairs**, Vol. 73, No. 4.
[20] European Commission, (2010a), "European Competitiveness Report 2010: An integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Front Stage*"*, **Commission Staff Working Document**, p.22. http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=6222(21.11.2011)

*EU in the world market, the relative trade balance (RTB), and an index of revealed comparative advantage (RCA)*are used to measure international markets.[21]

In the Global Competitiveness Report (GCR) 2010-2011, competitiveness is explained as *the set of institutions, policies, and factors that determine the level of productivity of a country*. The relation between productivity and growth is defined by referring to rate of return. Since productivity level affects rate of return gained as a result of the investments in an economy and the rates of return are important determinants of growth rates, raising productivity increases rates of return which in turn motives investments and growth. From a very broad perspective, GCR defines competitiveness at 12 pillars, which are classified under 3 economic development levels due to the fact that productivity and growth is affected by many factors at the same time by different levels.[22]

World Competitiveness Yearbook (WCY) is another report ranking countries in terms of their global competitiveness according to the criteria determined by Institute for Management Development (IMD). In WCY, more than 300 criteria are used. In order to gather such huge information, statistical indicators such as macroeconomic indicators and survey data such as management practices, labor relations are used. The report separates competitiveness into four main factors: *Economic Performance, Government Efficiency, Business Efficiency and Infrastructure.*[23]

Council on Competitiveness is a nongovernmental organisation in USA consists of CEOs, university presidents and labor leaders and known with its studies on competitiveness in USA. In the report, "Competitiveness Index: Where America Stands" that is published in 2006, one of the striking opinions in the report is recognition of new sources of competitiveness.It is stated that since manufacturing is spread to different regions of the world with low costs, its *competitive value* has

[21]European Commission, (2009), **EU industrial structure 2009 Performance and Competitiveness**, p.90. http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=5580; European Commission, (2001a), "European Competitiveness Report 2001", **Commission Staff Working Paper**, SEC (2001), 1705, p.5.
[22] World Economic Forum, (2010), **The Global Competitiveness Report 2010–2011**, p.4. http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2010-11.pdf(21.11.2011)
[23]Institute for Management Development, (2010), **IMD World Competitiveness Yearbook 2010**, pp.474-476.http://www.imd.org/research/publications/wcy/upload/methodology.pdf(21.11.2011)

declined. The new primary sources are defined as *innovation in advanced manufacturing, services and intangibles*.[24] In another report prepared by Deloitte and US Council on Competitiveness, a relatively different perspective is used and global competitiveness indicators are listed by responses of more than 400 senior manufacturing executives worldwide to a wide-ranging survey. The main difference of the Index is explained as its complementary role to other indices of World Economic Forum and IMD which are based on *historic country-level data*, since this Index shows how manufacturers perceive most important drivers of competitiveness.[25]

Global Federation of Competitiveness Councils (GFCC) defines itself as a global network of leaders from Competitiveness Councils around the world with the aim of *sharing best practices among councils and creating a new network of global leaders committed to their national prosperity and the prosperity of the world.* The founders of the GFCC are competitiveness councils of USA, Brasil, Egypt, Korea, Russia, Saudi Arabia and Emirates. In December 2010, GFCC hold its first annual meeting and set its *principles to guide national competitiveness in the global economy.* The main principles of GFCC can be summarized as public-private partnership and private sector involvement in investment in research and development, skilled and educated workforce, economic clustering, intellectual property rights, infrastructure, transparent and fair trade, transparency and efficiency in governments and the interaction between government and private sector, innovation through improved natural resource productivity and energy efficiency. GFCC states that the indicators for competitiveness should be *"forwardlooking metrics"* measuring inputs such as *education, research and development spending, patents and outputs such as job creation, new industries and products, GDP growth and quality of life.*[26]

In this part of the study, the definitions and indicators of competitiveness are examined from a very broad perspective. Definitions and patterns of competitiveness

[24] Council on Competitiveness, (2006), **Competitiveness Index: Where America Stands**, p.13 http://www.isc.hbs.edu/pdf/Competitiveness_Index_2007.pdf(21.11.2011)
[25] Deloitte & Council on Competitiveness, (2010), **2010 Global Manufacturing Competitiveness Index**, p.5. http://www.compete.org/images/uploads/File/PDF%20Files/2010_Global_Manufacturing_Competitiveness_Index_FINAL.pdf(21.11.2011)

[26] Global Federation of Competitiveness Councils, (2010), **2010 Global Competitiveness Principles**,p.3. http://www.thegfcc.org/(21.11.2011)

from different regions and institutions of the world are gathered in order to understand how competitiveness is perceived, measured and what is tried to be succeeded by economic decision makers in today's world.

The first conclusion is the perception of competitiveness as a "multi dimensional concept". There is a common view that economy has various aspects related with different stakeholders which are all important and complementary. For instance, one reports observes more than 300 criteria in order to measure overall competitiveness of a country, another one classifies importance of the criteria according to the economic development level of the country and emphasize different objectives for each country. In the reports and studies every stakeholder in the economic environment has different objectives that completes others. For example, the role of government includes providing stable economic and political environment, managing public balance, investing on health and education etc. while the private sector is stated to be responsible for contributing more on R&D investments, establishing more efficient business organisations and practices etc.

The second conclusion, which indeed completes the first one, is the common final objective of these reports and studies which is tried to be succeeded by dealing with various aspescts and indicators of competitiveness. When the definitions and main objectives are considered the competitiveness can be defined as the practices, institutions and factors used for sustained increase in productivity and prosperity of a country.

1.2.3. Technology and International Competitiveness

The definitions above show that technology has become a widely accepted driver of competition. European Commission states that productivity gains can occur by strengthening the innocative firms while Global Competitiveness Report reflects the impact of innovation on competitivenes by referring to higher education and training, technological readiness and innovation in its 12 pillars. Also, GCR seperates the level of economies and defines "innovation-driven ecomoies" as the most developed economies. Similarly, IMD explains the role of technology in World Competitiveness Yearbook

under the heading of "Infrastructure" which includes Technological and Scientific Infrastructure and Education. Council on Competitiveness states one of the main changes in business environment as *end of developed markets' near monopoly on advanced technology* and mentiones *innovation and education* in long term challenges. Also, in the joint report of Council on Competitiveness and Deloitte, talent-driven innovation is ranked as the most important driver of competitiveness by the senior executives participated in the survey. Finally, Global Federation of Competitiveness Councils (GFCC) emphasizes the need for applying "forwardlooking metric" for measuring competitiveness such as education, research and development spending, patents and new products. These references for defining competitiveness is a clear indicator of the increasing importance of technology as a factor of competitiveness.

1.2.4 Indicators of International Competitiveness

Beside the term competitiveness, some studies use the term "international competitiveness" in order the compare the competitiveness relatively to other countries. In the Commission reports, external competitiveness is defined as *the ability to export goods and services in order to afford imports*[27]. OECD defines competitiveness in international trade *as a measure of a country's advantage or disadvantage in selling its products in international markets*.[28] These definitions emphasize exports of a country and external balance as the main indicators of international competitiveness. Similarly, Andrea Boltho, from University of Oxford, defines competitiveness by referring to the *external equilibrium* and states that competitiveness can be defined as *highest possible growth of productivity that was compatible with external equilibrium* from a long-run perspective.[29] The frequently used indicators to compare international competitiveness are summarized below:

1.2.4.1 Share in World Markets

Export market share shows the position of a country or a sector relative to its international rivals. While comparing export shares different aspects of competitiveness

[27]European Commission, (2010a), p.22.
[28]OECD, **Glossary of Statistical Terms**.http://stats.oecd.org/glossary/detail.asp?ID=399(21.11.2011)
[29]Boltho, Andrea, (1996), "The Assesment: International Competitiveness", **Oxford Review of Economic Policy**, Vol. 12, No. 3, p.3.

can be emphasized. The market share of a single sector of a country can be compared with the same sector in other countries. Such a comparison make it possible to establish more detailed policy implications. Another alternative is comparing total exports of a country as a percentage of total exports in the world. By doing so, an overall view of the country's international competitiveness can be provided. Competitiveness of a single sector of a country can be compared with same sector in other countries in the world as follows:[30]

Export Share of a sector=$X_{ij} / \sum_j X_{ij}$

Where i is an individual industry and j is a country.

A more recent application is comparing the market share of a country in high technoloy products market in the world due to increasing focus on R&D and high technology products as a factor of competitiveness. For measuring market share of high technology products in global markets a similar Formula with the one above can be used by defining "i" as the sector high technology products.[31]

1.2.4.2Relative Trade Balance

Second indicator of international competitiveness is relative trade balance (RTB). This indicator can be also used for a sector or a country. If it is calculated at sector basis, it can be defined as *trade balance relative to the total trade in that sector*. It can be shown as follows:[32]

$RTB_i = (X_i - M_i) / (X_i + M_i)$

Where i is sector, X is value of exports and M is value of imports.

[30]Hughes, Kirsty, (1993), "The Role of Technology, Competition and the Skill in European Competitiveness", Kirsty Hughes (Ed.),**European Competitiveness**, Cambridge University Press, p.134;European Commission, (2009), p.135; Council on Competitiveness, (2006), p.59
[31]OECD, (2009), **Science, Technology and Industry Scoreboard 2009**, p.87.http://www.oecd.org/document/26/0,3343,en_2649_33703_39493962_1_1_1_1,00.html(21.11.2011)
[32] European Commission, (2009), p.137; Council on Competitiveness, (2006), p.60

1.2.4.3Revealed Comparative Advantage

The third indicator is Revealed Comparative Advantage (RCA) whichcan be applied at sector basis and compares share of a sector's exports in total exports of a country with the share of that sector in total exports of reference country. It can be shown as follows:[33]

$$RCA = (X_{ai} / \sum_i X_{ai}) / (X_{ri} / \sum_i X_{ri})$$

Where i is a sector, X_a is exports of a country and X_r is exports of reference country.

In this part of the study, a common definition for competitiveness is searched and definitions of different public and private authorities and institutions are summarized. Also, the perception of technology as a driver of competitiveness and indicators of export performance (so called international competitiveness[34]) are mentioned in order to choose an indicator that is going to be used in the regression models in Empirical Study chapter that represents international competitiveness performance.Taking into consideration the increasing focus on technology as a factor of competitiveness and the fact that high technology sectors are crucial in the competitiveness of the economybecause they are more suitable for *gaining larger markets shares, creating new markets for products and using resources more efficiently; leading to high-value added production and bringing higher returns to the workers they employ, creating spill-over effect to the overall economy*[35],market share in high technology exports is chosen as an indicator of international competitiveness rather than a sector or all exports.

[33]Hughes, Kirsty, (1993), p.148; European Commission, (2009), p.138
[34]See definitions above.
[35]Eurostat, (2010a), **Science,Technology and Innovation in Europe**, p.219.http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-EM-10-001/EN/KS-EM-10-001-EN.PDF

CHAPTER 2:R&D POLICIES IN TURKEY

2.1. HISTORICAL PERSPECTIVE: DEVELOPMENT PLANS

In order to observe the development of science and technology policies in Turkey, the five year development plans that include the policy aim, target and practices are considered as useful tools. 9 development plans have been prepared from the first one covering the period of 1963-1967. The evolution of the plans in terms of content, aim and methodology is worth mentioning for following the change in methodology of and attitude towardsR&D activities. The main features of development plans are summarized below in chronological order.

In the first Five Year Development Plan (1963-1967) scienceand technology is evaluated under the "Employment, Education and Research" heading and separated into two as basic and applied research. The main feature of the first plan is the usage of broad statements and the lack of long term strategies for technology transfer, education policy, R&D etc.[36]In this period, establishment of Science and Technical Research Council and Social and Economic Research Institute is planned as primary objectives.[37]

In the second development plan, a new heading 'Science and Research' was opened and a picture of the current situation in Turkey and world was drawn.[38]Secondly, the need of coordination for the establishment and implementation of science and technology policy is mentioned for the first time. The target of GERD in the period was set as 0.6% which is, indeed, reached in the beginning of 2000.

In the third Five Year Development Plan (1973-1977) , the problems occurring due to the high share of agriculture and services sector are defined. Creation of a strong industry composed of big sized companies was stated as a prerequisite for the improvement of technological infrastructure.[39] The lack of corporate structures for the

[36]Göksel, Nilüfer, **Türkiye'de Bilim ve Teknoloji Politikalarının Gelişimi ve Teknoloji Transferi**, p.1. http://www.dtm.gov.tr/dtmadmin/upload/EAD/TanitimKoordinasyonDb/turkiye.doc, (21.11.2011)
[37]State Planning Organisation,(1963), **Kalkınma Planı (Birinci Beş Yıl),**p.467.http://ekutup.dpt.gov.tr/plan/plan1.pdf(21.11.2011)
[38]State Planning Organisation, (1968), **İkinci Beş Yıllık Kalkınma Planı**, p.197.http://ekutup.dpt.gov.tr/plan/plan2.pdf(21.11.2011)
[39]State Planning Organisation, (1973), **Üçüncü Beş Yıllık Kalkınma Planı**, p.115. http://ekutup.dpt.gov.tr/plan/plan3.pdf(21.11.2011)

management of technology transfer and the infrastructure for the national technology creation are the issues repeated in this plan.[40]

The eye catching issue in the fourth development plan (1979-1983) was structural problems about the technology transfer. The problem in the technology transfer process to developing countries was defined as follows: "*The technology transfer is done under the forms of patents, licensing, know how agreements, foreign direct investments, machinery and hardware etc. since the knowledge is generally spread to developing countries as a package and the recent technology is bought beside the new technology, the cost of technology transfer increases.*"[41] In order to handle the problems in the plan, Turkish Science Policy (1983-2003) was announced in 1983. In this policy, long term objectives were set by observing the recent situation at that time. However, the determined targets were not reached and the policy was updated after 10 years.[42]

In the fifth Five Year Development Plan (1985-1989), like the previous ones, the main problems were stated as the weak transformation of scientific outputs to the business environment, lack of resources and coordination. The main difference of the plan was the announcement of key sectors and the incentive mechanisms.[43]

The main difference of the sixthdevelopment plan (1990-1994) was the existence of more tangible targets. The new targets were explained as follows*:"...in order to become a knowledge society and complete infrastructure for information and communication Technologies, the number of researchers, which is 33.000 will be doubled, the number ofR&D personnel per 10.000 population will increased to 15. Finally, high effort will be shown to increase GERD to 1%*."[44]

In the seventh Five Year Development Plan (1996 and 2000),the main problems of the period were explained as follows: "*technological investments based on*

[40]Göksel, Nilüfer, p.3.
[41]State Planning Organisation, (1979), **Dördüncü Beş Yıllık Kalkınma Planı,**p.49. http://ekutup.dpt.gov.tr/plan/plan4.pdf(21.11.2011)
[42] Goksel, Nilüfer, p.4
[43]State Planning Organisation, (1985), **Beşinci Beş Yıllık Kalkınma Planı**, pp. 159-160.http://ekutup.dpt.gov.tr/plan/plan5.pdf(21.11.2011)
[44]State Planning Organisation (1990), **Altıncı Beş Yıllık Kalkınma Planı**, p.309.http://ekutup.dpt.gov.tr/plan/plan6.pdf(21.11.2011)

productions were not succeeded. The institutions and the funding necessary to establish techno parks and related bodies are not provided. Due to these problems, competitive advantage was not gained. Since the technology transfer is the main source of knowledge, so much foreign exchange was spend to technology transfer. "[45]

In the development plan covering the period of 2001 and 2005, R&D was mentioned under the heading of "Developing Skills for Science and Technology". As mentioned in the previous plans, university-public-private coordination was emphasized and the R&D is stated to be a key concern in public procurement. By stating the importance of information and communication technologies, the necessary legal, technical and administrative regulations are said to be completed immediately.[46]

The ninth Five Year Development Plan which will be valid until 2013, R&D is mentioned under the heading of Developing Competitive Advantage. Three pillars are stated as the improvement in R&D and innovation, common usage of ICT and producing high value added products. Evaluating R&D policies directly under the issue of international competitiveness provides clue of how the policies are affected by the conjecture they are established. Also the contribution of private sector was emphasized.[47]

2.2. EU MEMBERSHIP PERSPECTIVE

Science and Research Chapter is one of the 35 chapters that are going to be handled during the negotiation process of EU membership. Progress reports, that are prepared by EU Commission, express the developments in the candidate country regarding the chapters. European Commission began to prepare progress reports in 1998 when Turkey gained the status of candidateship and the last progress report was the 2010.

Chapter 25: Science and Research Chapter and Chapter 20: Enterprise and Industrial Policy are the two main indicators because research and development policies

[45]State Planning Organisation, (1996), **Yedinci Beş Yıllık Kalkınma Planı**, p.71.http://ekutup.dpt.gov.tr/plan/vii/
[46]State Planning Organisation, (2000), **Sekizinci Beş Yıllık Kalkınma Planı**, pp.125-129.http://ekutup.dpt.gov.tr/plan/plan8.pdf(21.11.2011)
[47]State Planning Organisation, (2006), **Dokuzuncu Beş Yıllık Kalkınma Planı**, p. 68.http://ekutup.dpt.gov.tr/plan/plan9.pdf(21.11.2011)

have different reflections and policy requirements in both chapters. The main performance indicators for Science and Research Chapter are *existence of the necessary conditions for effective participation in the Framework Programs andensuring the successful implementation of the acquis in this domain.*[48]In the progress reports under the Science and Research Chapter, which is the only closed chapter, the increasing participation in framework programs and improving institutional structure are explained as main developments while the insufficient contribution of private sector and SMEs is emphasized.

Like the national development plans, progress reports show the chronological development process in Turkey in science and research, but from the EU perspective. As it was stated in the beginning, science and research chapter mainly focus on the implementation of framework programs and European and Turkish Research Areas that work under them. The temporarily closing of the chapter and the progress appreciated in the progress reports should be interpreted by considering this fact. What really matters for the subject of this study is the reflection and transmission of these developments into the economic development and providing solutions to some economic problems like the international competition and vulnerability of the Turkish economy. Here, the industrial policy chapter becomes an important tool to measure this transmission. It is a fact that in the R&D policies have been mentioned just recently in this chapter, but it is because the progress reports generally emphasize the problems in an order according to the level of economic development that the candidate countries experience from their perspective.That can be stated as why since 2002 the main problems were stated as the crisis, the FDI and privatization and finally the in the last reports transition to the knowledge based economy and R&D expenditures were began to be addressed by mentioning the investment environment of R&D sector.

2.3 SCIENCE AND TECHNOLOGY POLICY IN TURKEY

The highest ranking science and technology policy-making body in Turkey is Supreme Council for Science and Technology (BTYK) responsible for establishing all

[48]European Commission, (2004a), **2004 Regular Report on Turkey's Progress Towards Accession**, SEC (2004), 1201, p.123.

strategies and targets for technology driven economic growth. There are also other institutions assisting to decision making process and operational activities namely DPT,TUBITAK, KOSGEB, Ministry of Industry and Trade, Technology Development Foundation of Turkey (TTGV), Techno parks and related public and private organizations etc.[49]

2.3.1. Supreme Council for Science and Technology

Supreme Council for Science and Technology (BTYK) was founded in October 1983 with the Decree Law No. 77. The main objectives if the Council is defined as implementation of the Turkish Science Policy, assisting the government in determination of long termed S&T policies, identification of targets, elaboration of plans and programs, assignment of public organs, establishment of collaboration with private establishments, elaboration of required laws and legislation, provision of human resources development for researches etc. by the law. The Supreme Council for Science and Technology is chaired by the Prime Minister and related ministers such as Ministers of State, National Defense, Economy, National Education, Health, Forestry and Rural Affairs, Industry and Trade, Energy and Natural Resources; Chairman of Council of Higher Education, Undersecretary of State Planning Organization, Undersecretaries of Treasury and Foreign Trade, President of TUBITAK and a Vice President, Chairman of Turkish Atomic Energy Authority, General Director of Turkish Radio and Television, Chairman of Union of Chambers and Commodity Exchanges of Turkey, and a member to be appointed by a university to be designated by the Council of Higher Education.[50]

2.3.2. National Science and Technology Policy

BTYK assigned the responsibility of establishing the strategy for the next 20 year until 2023 to TUBITAK in its December 2000 meeting. TUBITAK started the "Vision 2023 Project"in 2002 and completed the document in more than 2 years. In order to establish the Strategy, the process in the figure below was applied. In the first phase, 2023 vision was drawn by "technological foresight study" which is composed of

[49] TUBITAK, (2010), **The Republic of Turkey's Model of Instigating an STI Impetus**, p.4.http://www.tubitak.gov.tr/tubitak_content_files//BTYPD/arsiv/Special_Brief_Guncel19_Web.pdf(21.11.2011)
[50]TÜBİTAK, **Supreme Council for Science and Technology**. http://www.tubitak.gov.tr/sid/1003/pid/547/index.htm(21.11.2011)

192 meetings and 36 broad panels lasted more than 1 year organized by the participation of 250 experts from public and private institutions and universities. Also, a Delphi survey was applied and documented by feedback from 2400 experts. Finally, Strategic Technology Groups were formed in the 8 main study fields determined in the panel studies. By analyzing the Technological Foresight Panel conclusions and Panel synthesis Report, and Strategic Technology Groups reports, 24 reports were prepared for guiding all institutions while establishing their own R&D strategies.[51]

Figure 2.1: Steps for Estalishing National Science and Technology Strategy

Source: TUBITAK, (2004), **2003-2023 Strategy Document**, p.5, http://www.tubitak.gov.tr/tubitak_content_files//vizyon2023/Vizyon2023_Strateji_Belgesi.pdf(21.11.2011)

In the second and third phase, the socio-economic targets that form the vision of 2023 and the necessary steps and priority development activities are set. A quite detailed mapping is formed under the headings of sustainable development, gaining competitive advantage in manufacturing, strengthening technological infrastructure through the transition to knowledge society and increasing standard of living. One of the remarkable features of the document is the list of 8 strategic areas at the core of priority development activities. These 8 headings are stated as "*information and communication technologies, biotechnology and gene technologies, nanotechnology, mechatronics, production process and technologies, materials technologies, energy and environment technologies and finally the design technologies*."[52].

[51]TUBITAK, (2004),p.8.
[52]TUBITAK, (2004), p.33.

As it was established in Lisbon Strategy, some clear targets for financing of R&D activities are set to create political will. The targets are set to be reached until 2013. The targets for Turkey for 2013 are set by considering the level in EU in 2004 which, indeed, maintains the gap with EU.Table 2.1 shows the targets set for 2013.

Table 2.1: National Science and Technology Strategy Targets on R&D Expenditures

Gross domestic expenditure on R&D as % of GDP (GERD)	2%
Business enterprise R&D exp. (BERD) / overall R&D expenditures(GERD)	65%
Share of "high tech" exports in the manufacturing R&D exports	40%

Source: TUBITAK, (2004), p.38.

The instruments for reaching these targets are explained as creation of National R&D Fund under Turkish Research Area which is suggested to be obtained by a 2% tax from public procurements; establishment of directed R&D projects by putting specific obligations for public institutions to allocate determined share of budgets for institution – related projects which are defined as priorities; providing supports for firm start-ups and regional networking efforts etc.

The development of human resources is attached to the university-industry linkage in the report. The low share of private sector in R&D activities is mentioned and the universities are defined as core of science and technology policies. Emphasize on the involvement of academicians in the business sector is an example of new perspectives in the document. As it is mentioned in the university-industry linkage part, there are some laws seriously restricting the relations of academicians with the private sector.

There are some numerical targets for the human resources in R&D activities. Like the ones about financing of R&D, the human resources targets are based on the recent EU averages in related issues. Table 2.2 shows the targets regarding human resources.

Table 2.2: National Science and Technology Strategy Targets on Human Resources

Number of researchers per 1000 employment	6
Business sector researchers / total researchers	50%
Doctorate students per 1000 pop. (age 25-34)	0.5

Source: TUBITAK, (2004), p.42.

2.3.3. University – Industry Linkage in Turkey

There has been a weak co-operation between industry and university despite the important laws and programs implemented in last 15 years. The historical trend mentioned for the science and technology policies in the 5 Year Development Plans is valid for the university-industry linkage (UIL). Tangible efforts were started after the establishment and proper functioning of TUBITAK in the early 1990s. Generally, the UIL takes form of *summer industrial practice of students from universities, contract base projects for firms, providing laboratory and some special design services via university centers etc.* and there are some more recent trends such as *Technology Development Zone Law for techno parks, University Industry Joint Research Centers Program (USAMP), R&D Law etc.*[53]

The Technology Development Zones (TDZs) Law numbered 4691 was issued in 2000, effective since 2001 and being conducted by Ministry of Industry and Trade. It is regulating establishment of techno parks in co-operation with the universities and research centers to provide the infrastructure required for facilitating technological innovation. The management of techno parks are handled by 'Managing Company' and this company is responsible for providing consulting services in education, patenting, firm establishment, technology transfer, financing, venture capital, marketing and exporting social structures. Universities (there must be at least one university), Banks and Financial Associations, Local Administrations, Unions of Exporters etc. can be founders or shareholders of the managing company. Also, foreign private legal entities can participate in the company.. Some incentives are provided to the participant companies such as land procurement, construction of infrastructure and management building, value added tax (VAT) exemptions for the software development activities,

[53]Korea Development Institute, (2009), **Models for National Technology and Innovation Capacity Development in Turkey**, p.161.http://www.ttgv.org.tr/content/docs/final-report_turkey-ksp.pdf(21.11.2011)

income tax exemptions for the salaries of the researchers, software engineers, and R&D etc. The sectoral composition of the TDZs is dominated by Software & IT, electronics and defense.

In 2007, in parallel with European Technology Platforms initiative, some "Technology Platforms" were established in Turkey in different sectors to improve the university-industry linkage. The recent platforms are Automotive, Textile, Metal, Electricity and Electronics, Marine and Sea Technologies, Energy, Pharmaceuticals, Agriculture, Construction Technologies. In the 2007-2008 period, firstly some workshops are organized in order to determine the framework of the platforms in different sectors, then the technology platforms are established and some of the platforms organized expertise meetings for the implementation process.[54]

Main advantages relating the university-industry linkage seem to be the increasing concern and efforts on this subject. The share of higher education R&D financed by industry can be used as measure since it shows how much industry spends on the R&D activities performed by universities. Statistics show that in the period of 1995-2004, industry financed R&D increased almost %80.

The main weakness of the relationship is the existing dominance of the traditional sectors in the economy not so open to innovation which is going to remain as a problem with the recent speed of transformation process. The business R&D expenditure is quite low regarding the OECD countries although it increased in last 10 years. Although most of the research is performed by universities by producing a high level of output, the transformation to the industry is still weak due to the recent regulation and legislation discouraging the collaboration with the industry and the academic curricula not matching with the needs if the business.

[54]TUBITAK, **Teknoloji Platformları.**http://www.tubitak.gov.tr/sid/909/pid/900/index.htm(21.11.2011)

CHAPTER 3: LISBON STRATEGY

3.1 THE ROAD TO LISBON

3.1.1 Macroeconomic Developments

In order to understand the ambitious targets set in Lisbon Strategy, the trend in main macroeconomic indicators in 1990s should be analysed for European Union and its main rivals in that conjuncture such as USA and Japan. As it is mentioned below in more detail, output and productivity growth in EU experienced a very similar trend with USA between 1970 and 1990 but these indicators reversed especially after mid 1990s. The recognition of the need for structural reforms due to the worsening economy is the answer to the question "Why Lisbon?" Main macroeconomic indicators such as growth of real GDP and its main contributors employment growth and labour productivity are observed for comparison.

Table 3.1 shows that the period between 1975 and 2001 includes different performances of the three rivals and can be divided to sub periods accordingly. Until 1990, Japan showed a significant growth performance that others do not experience in any point of the whole period concerned. EU experienced a convergence to USA till 1990 while average growth in USA was declining. After 1990, these two trends reversed. Both Japan lost its momentum and USA accelerated its growth performance. The average annual growth in Japan dropped first to 1,5% between 1990 and 1995 and then to 1,1% between 1995 and 2001. USA and EU experienced a similar trend in 1990s in which both rivals experienced a slowdown in the first half and then the growth re-accelerated in the second half but the growth performance of USA was definitely higher than EU.

Table 3.1: Growth of Real GDP in EU, USA and Japan between 1975-2001 (AAGR - %)

	1975-1985	1985-1990	1990-1995	1995-2001
EU-15	2,3	3,2	1,5	2,6
USA	3,4	3,2	2,4	3,9
Japan	3,8	5,2	1,5	1,1

Source: European Commission, (2001a), **European Competitiveness Report 2001**, Commission Staff Working Paper, SEC (2001), 1705, p.18.http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=6232

In the observed period, *the unification of Germany, the transition to CEEC, the loss of the Russian market, the political turmoil in the Balkan region and devaluations in some member states* deeply affected EU performance. Ireland has the highes growth performance due to research intensive industries, chemicals and machinery and printing industries while strong economies such as Finland and Sweden were struggling with banking sector and currency devaluations.[55]

On the other hand, the high performance of USA especially after 1995 is partly explained by the increasing use of Information and communication Technologies and its impact on the economy. In the report "The Emerging Digital Economy" prepared by US Department of Commerce in 1998, the economic importance of Information Technologies is explained by referrring to *IT's share of investment activity and GDP mainly including increasing productivity and efficiency especially in the sectors like communications, insurance and investment brokerages*[56]In Commission's 2000 Competitiveness Report, ICT industries in USA and EU in 1990s is compared and concluded that ICT expenditure as a percentage of GDP is lower in EU and the slower readiness of EU for new products increases the time lag for appearance of the benefits of investments.[57]

[55]European Commission, (1999a), **The Competitiveness of European Industry – 1999 Report**, Working Document of the European Commission, pp.7-8.http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=6230f(21.11.2011)
[56]US Department of Commerce, (1998), **The Emerging Digital Economy**, pp.4-7.http://govinfo.library.unt.edu/ecommerce/EDEreprt.pdf(21.11.2011)
[57]European Commission, (2000), "European Competitiveness Report 2000", **Commission Staff Working Paper**, SEC (2000) 1823, pp.49-50.

The GDP growth is stated to be determined by employment growth and growth in labour productivity in the competitiveness reports of European Commission.[58]

Table 3.2: Employment Growth in EU, USA and Japan between 1975-2001 and Employment Rates in 2001 (AAGR - %)

	1975-1985	1985-1990	1990-1995	1995-2001	Employment Rate in 2001*
EU-15	0,1	1,4	-0,5	1,2	62,6
USA	2,2	2	0,9	1,4	73,1
Japan	0,9	1	0,7	0	68,8

Source: European Commission, (2001a), p.22

*Eurostat, (2010b), **EU Economic Data Pocketbook/ 2-2010**, p.100.http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-CZ-10-002/EN/KS-CZ-10-002-EN.PDF

As it is seen in Table 3.2, the main source of growth in USA since 1980s is the total employment performance. This trend continued in 1990s and in USA more jobs are created than EU in the whole period. Although employment rate growth accelerated in EU in the second half of 1990s, it was not enough to close the gap. The impact of employment on GDP growth is affected by average hours worked per person in employment, labour force participation rate and the unemployment. In the first half of 1990s, due to declining employment rates and reductions in average hours worked, the contribution of employment to growth was very low relatively to USA. Although the employment performance increased after 1995, the labour contribution to GDP per capita in EU was only one third of USA.[59]

Table 3.3: Labour Productivity Growth in EU, USA and Japan between 1975-2001 and Labour Productivity in 2001

	1975-1985	1985-1990	1990-1995	1995-2001	Labour productivity in 2001* (EU=100)
EU-15	2,2	1,8	2	1,3	100
USA	1,2	1,2	1,5	2,5	140
Japan	2,9	4,1	0,8	1,1	98

Source: European Commission, (2001a), p.22.

* Eurostat, (2010b),p.92.

[58]European Commission, (2001a), p.18;European Commission, (2000), p.30.
[59]European Commission, (2001a), p.19.

In the 1960s, the level of productivity in EU was half of the level in USA. During the last three decades as a result of strong productivity growth (increase in output per employee), Table 3.3 shows that EU managed to partially catch-up with USA. But, this trend reversed after 1995 and USA showed higher performance than EU and Japan. As it is seen in the table, the labour productivity in USA is 140% of EU.[60]

The widening gap in GDP levels of USA and EU which is composed of the employment and productivity differences between the two rivals showed the necessity for structural changes and reforms. Technological progress as a factor of productivity and the important tool of the so called "new economy" rising in USA lead to the objective of becoming "knowledge based economy"*.The problems in labour market in terms of securing jobs and increasing competitiveness at the same time and also increasing the participation of older workers against the effects of "ageing" of population lead to establishment of the terms "flexicuriy" and "life cycle" approaches. These structural developments, that are established as the main goals of the Lisbon Strategy, are mentioned in the following parts.

3.1.2. Industry Policy and Competitiveness in the Acquis Before Lisbon

Industrial policy is mentioned in a Treaty first time in 1992. In Article 157 of Treaty for European Union, it is suggested that actions taken ensuring competitiveness of the Union's industry shall aim *speeding up the adjustment of industry to structural changes, fostering better exploitation of the industrial potential of policies of innovation, research and technological development, …"*In the Treaty, the importance of harmonisation of policies and activities for achieving the objectives is also emphasized.[61]

In 1994, Commission published a communication called "An Industrial Competitiveness Policy for the EU". In this paper, the challenges and the prior action areas are mentioned. The main problems that EU faces are explained as *mounting*

[60]European Commission, (2001a), pp.21-23.
[61]European Council, (2010), "Consolidated Version of the Treaty on the Functioning of the European Union", **Official Journal of the European Union**, C 83/ 30.3.2010, p.125.
* "The knowledge Based Economy" is an expression coined to describe trends in advanced economies towards greater dependence on knowledge, information and high skill levels, and the increasing need for ready access to all of these by the business and public sectors. http://stats.oecd.org/glossary/detail.asp?ID=6864(21.11.2011)

international competition, technological innovations (information technology, biotechnology, etc.) which led to intangible investments (in research, patents, training, etc.) growing faster than capital investment …"[62] The main actions to be taken in the paper can be summarized as *promoting intangible investment, developing industrial cooperation, ensuring fair competition and modernizing the role of the public authorities.*[63]The communication shows that the opening gap with USA in the 1990s and the high growth performance of US companies, IT sector in particular, motivated EU towards applying the same strategy with its rival based on investing on new technologies, creating a large market by integrating national markets and benefit from competition between firms by increasing productivity.

Following the communication of the Commission, Council established a Decision on 25.06.1996, in order to determine the instruments and the action plan to implement the Communication in 1994. The action plan in the Council Decision repeated the objectives of the Communication and added the actions of strenghtening industrial cooperation with country groups such as Asia, Southern Africa, Latin America etc. Another important point in the Decision is the introduction of annual competitiveness reports.[64]

One of the important debates in Lisbon Strategy is the use of benchmarking as an instrument to provide coordination between EU members for reaching the overall objectives. In 1997, Commission published the Communication, "Benchmarking – Implementation of an instrument available toeconomic actors and public authorities" to discuss the principles of benchmarking and the policy areas where benchmarking can be effective and reasonable.[65]

In 1999, Communication of the Commission, "The Competitiveness of European Enterprises in the Face of Globalisation – How It Can Be Encouraged", were published which summarizes the effects of globalization on European economy and the

[62]EU Commission, (1994), **An Industrial Competitiveness Policy for the EU**, COM (1994), 319 Final, p.1.
[63]EU Commission, (1994), pp.25-35.
[64] European Council, (1996), **Council Decision of 25 June 1996 on the Implementation of a Community Action Programme to Strengthen the Competitiveness of European Industry**, 94/413/EC, p.2.
[65]European Commission, (1997), **Benchmarking –Implementation of an Instrument Available to Economic Actors and Public Authorities**, COM (1997), 153 Final, p.3.

necessary adjustments that has to be made in order to fit the driving elements of globalization such as the *rise of technological evolution, new forms of international collaboration and multinationals, international financial markets* etc.[66] By considering these new elements in international environment, *new key factors of competitiveness* are summarized as knowledge-based industries, internet and electronic commerce, SMEs, skilled workforce and sustainable development.[67]

The debate on competitiveness and establishment of a sustainable industrial policy has began in the beginning of 1990s before the Lisbon Strategy. When the goals and instruments of the Lisbon Strategy, that are explained below, is compared with the reports of the Commission and the Council in 1990s, it can be concluded thatLisbon Strategy is used as an overall "framework" for the enlarging acquis on the action plans and instruments designed for adapting to the new economic environment and challenges.

3.2 THE LISBON STRATEGY

At the March 2000 European Council in Lisbon, Portugal, a group of actions called Lisbon Strategy were established for making the Europe "*the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion*"[68]. In June 2001, Gothenburg European Council, an environmental pillar was also added. This challenging goal that contains different – and many - pillars was EU's defense against the disturbing effects of globalization, ageing, enlargement and ecological fragility.[69] In order to realize this goal, some – more concrete – targets were established. The most important of these targets can be stated as *70% employment target, several skills targets (less early school leavers, more graduates from secondary education, increased reading*

[66]European Commission, (1999b), **The Competitiveness of European Enterprises in the Face of Globalisation – How It Can Be Encouraged**, COM (1997), 718 Final, pp.6-7.
[67] European Commission, (1999b), pp.7-10.
[68]European Council, (2000), p.2.
[69] European Commission, (2005a), "The Economic Costs of Non-Lisbon: A survey of the Literature on the Economic Impact of Lisbon-type Reforms",**European Commission Occasional Papers**, No: 16, p.9.

literacy and more lifelong learning), and the 3% R&D target, the trade effects of opening up the services markets and less administrative burdens on companies.[70]

Due to the problems occurred in the implementation of the Lisbon Strategy such as existence of so many targets and objectives, lack of clearance in the responsibilities of national and European actors, difficulty for member states to prepare various policy-specific reports, lack of public communication, lack of national ownership and political will etc.[71] the Council decided to renew the Lisbon Strategy in 2005. Inspired highly from the reports of Wim Kok, "Facing the Challenge: The Lisbon Strategy for Growth and Employment' in 2004 and Andre Sapir, "An Agenda for a Growing Europe", in 2003, Commission published, the communication "Working together for growth and jobs: A new start for the Lisbon Strategy", to show the new path for Lisbon Strategy by accepting the previous mistakes and suggesting new solutions and governance mechanisms. Also, Commission prepared a particular communication called "More Research and Innovation - Investing for Growth and Employment: A Common Approach" for different aspects of research and innovation policy which is stated as the main tool for competition. These reports were launched in parallel with the documents established by the Council; Integrated Guidelines (IG) and the Community Lisbon Program. Also the national reform programs were taken into consideration for providing full consistency.[72] Finally an Action Plan was prepared to show the new road map for the implementation of the principles given in the documents above.

The renewed Lisbon Strategy determined two basic aims, employment and growth. Action plan is established to increase productivity and growth and provide

[70]Gelauff, G. and Lejour, A., (2006), "Five Lisbon highlights: The Economic Impact of Reaching These Targets", **CPB Netherlands Bureau for Economic Policy Analysis Document**, No: 104, p.12. http://www.cpb.nl/sites/default/files/publicaties/download/five-lisbon-highlights-economic-impact-reaching-these-targets.pdf(21.11.2011)

[71] See Part 3.2.3: Main Criticisms

[72]European Commission, (2005b), **Implementing the Community Lisbon Programme: More Research and Innovation - Investing for Growth and Employment: A Common Approach**, COM (2005), 488 Final, p.3.

better jobs to people. The main action areas are tried to be established in the same simplicity:[73]

- *Making Europe a more attractive place to invest and work*
- *Knowledge and innovation for growth*
- *Creating more and better jobs*

In this part, first, the overall governance mechanisms and their evolution are mentioned. Second, the main goals are detailed and finallymain criticisms against the Lisbon Strategy are summarized.

3.2.1. Governance

The main governance structures are determined as the Treaty based Broad Economic Policy Guidelines (BEPG) and Employment Guidelines (EG) which have been used since the adoption of Maastricht Treaty in 1992. Also two instruments were added to this structure: the Annual Review Meetings held by the heads of governments and the "Open Method of Coordination" (OMC). OMC was designed to provide progress of the member states jointly for the Lisbon targets. The main elements of OMC are guidelines, indicators and benchmarks for monitoring and comparing member states.[74]The recent working mechanism of Lisbon Strategy includes three-year periods starting at European level, a strategic report of the Commission that is completed by the BEGs and EGs prepared by the Council, and spreads to the national level, the national reform programs issued by referencing the supranational guidelines. This cycle continues with the next reporting of Commission interpreting the previous performance and setting new road maps.[75]

The Lisbon Strategy separated the main issues to be handled by the EU level institutions (for ex: market regulation, competition policy) and the national governments (for ex: fiscal policies). The degree of coordination (soft vs. hard) deeply affects the EU

[73]European Commission, (2005c), **Working Together for Growth and Jobs, A New Start for the Lisbon Strategy**, COM (2005), 24 Final, p.15.
[74] EU Commission, **Open Method of Coordination**.http://ec.europa.eu/invest-in-research/coordination/coordination01_en.htm#1(21.11.2011)
[75] European Central Bank, (2008), "Benchmarking the Lisbon Strategy", **European Central Bank Occasional Paper Series**, No:85, p.12.

wide coordination, performance, implementation and tools of the policies building up the Strategy. There are some ongoing debates and supporting arguments for both soft and hard policy coordination tools in the strategy. Regarding the hard coordination that requires action at European level, the main economic arguments are stated as *the existence of externalities (i.e. the fact that one country's actions affects other countries) and the necessity to prevent or reduce the likelihood of free-rider behavior by Member States, which may impose considerable costs on their partners.*[76]Hard coordination is stated to increase the efficiency of the Strategy as long as the costs of uncoordinated individual actions are high, the national governments fulfill their commitments (or can be forced to do so) and the countries gain from the increasing integration of the markets etc.

The main bases of the soft coordination at national level are *the exchange of information among policy-makers; learning from each other's experience, practices and intentions; national ownership; and the exertion of peer pressure to galvanize governments into taking appropriate policy action*.[77]

Finding the equilibrium between the hard and soft coordination seem to be one of the most difficult tasks of the policy designers of the Lisbon Strategy to avoid the situations of too much nationalization which will damage the discipline and the logic of internal market, and too much centralization that ignores the specific features of the countries causing the collapse of national ownership. Although, benchmarking is a useful tool for systematic comparison of countries it has weaknesses such as not having a coercive power for ensuring implementation. In order to pay attention to the country-specific issues, some suggestions were made for providing discretion to the member states for choosing the indicators to be evaluated but this also seem to be in contrast with the idea of transparency, comparability and naturally the benchmarking.[78]

There is a quite strong consensus that one of the biggest problems about the governance of Lisbon Strategy was the so many objectives on paper with no clear priority and division responsibility. For example, there were 42 structural indicators to

[76] European Central Bank, (2008), p.9.
[77] European Central Bank, (2008), p.13.
[78] European Central Bank, (2008), p.15.

be followed by the member states in 2002 which were decreased to 14 in the following period.[79]The result was *little action* and *limited ownership*. In the renewed Strategy, two main principal tasks mentioned in contrast to the huge list of objectives in the original one: *employment* and *growth.…Lisbon's overburdened list of policy objectives has obscured the importance of these actions which can drive productivity growth. From now on, structural reforms, through such policies, should be pivotal in the renewed Lisbon strategy."*[80] Monitoring of the indicators is stated as another problematic issue because of overlapping and bureaucratic reporting procedures. The new strategy designs a simplified reporting system. For example, the main reporting tool for the economic and employment measures is designed to be the National Lisbon Program which is expected to simplify the reports under existing "Open Method of Co-ordination".[81]

3.2.2. Main Goals

3.2.2.1. Making Europe a More Attractive Place to Invest and Work

In order to create a business friendly environment attracting entrepreneurs and gain from enlarged volume of trade by completing the single market, the Lisbon Strategy requires transposition of Acquis Communautaire to the national legislations of the member states, completion of financial integration, liberalization of the services sector and network industries and improvement in the application of the competition and state-aid policies,[82]a suitable climate for entrepreneurs with lower costs and less red-tape.[83]

It is both significant for making Europe an attractive place to invest and also improving the intra trade within the member states. Action is needed particularly in the area of services, regulated professions, energy, transport, public procurement and financial services which still have so many obstacles unlike the "goods" where

[79] European Commission, (2003), **Structural Indicators**, COM (2003), 585 Final, p.3.
[80] European Commission, (2005c), p.13.
[81]European Central Bank, (2008), pp.7-17.
[82]Kok, Wim, (2004), **Facing The Challenge:The Lisbon Strategy for Growth and Employment**,p.23. http://www.emins.rs/sr/dokumenti/downloads/2005/0411-lisbon-strat.pdf(21.11.2011)
[83]European Commission, (2005d), **Lisbon Action Plan Incorporating EU Lisbon Programme and Recommendations for Actions to Member States for Inclusion in their National Lisbon Programmes**, SEC (2005), 192, p.13.

remarkable progress was made in a quite long period of time.[84]Both the level and heterogeneity of regulations are stated to affect the trade of services by crating additional costs.[85]

State aid procedure is one of the most crucial issues for liberalization of European markets and creating a competitive environment for both local and foreign companies. Commission plans to re-organize and improve state aid procedures especially on innovation, R&D and risk capital issues.[86]Due to the shift of the emphasis from supporting individual companies or sectors towards reaching horizontal objectives of Community interest, such as employment, regional development, environment and training or research, Council has to reduce the state-aids particularly in the large countries like Italy and France.[87]

3.2.2.2. Knowledge and Innovation for Growth

In order to provide long term economic growth depending on creation of research and innovation based sectors that can compete in international markets, the Lisbon Strategy requires an R&D policy that is strongly tied to and coordinated with the other dimensions of the strategy including setting up of an area of research and innovation; boosting spending on R&D to 3 % of GDP; protecting intellectual property; fostering university-industry partnership; adapting a well established and qualified education and training systems for the knowledge society and increasing investment on human capital; attracting world-class researchers; creating an information society for all by defining a regulatory framework for electronic communications; encouraging the spread of ICTs; creating conditions for e-commerce and providing access of all stakeholders to information and communication Technologies.[88]

Two years after the launch of Lisbon Strategy, at the Barcelona European Council, EU leaders decided to increase R&D investments to 3% of GDP by 2010 from 1.9 % in 2000. 3% of GDP was the level that Japan had reached and USA had been

[84] World Economic Forum, (2008), **The Lisbon Review 2008 – Measuring Europe's Progress in Reform**, p.4.
[85]Gelauff, G. and Lejour, A.,(2006), pp.94-95.
[86] European Commission, (2005d), p.13.
[87] World Economic Forum, (2008), p.4.
[88]World Economic Forum, (2008), p.3.

approaching, so EU, with the aim of being a competitive knowledge economy, set a target of 3% which was perceived "tangible and realistic" in 2002. Also level of business expenditure on R&D is projected to increase to two-thirds of total R&D investment from 56 %. The Lisbon agenda and the national Lisbon programs of member states are established based on these main objectives.[89]In recent years member states have launched new tax incentives but since tax is responsibility of national governments they vary greatly which causes a fragmented and ineffective implementation. Commission has to make the necessary changes to handle common issues such as cross-border outsourcing of research, expansion of young research intensive firms, or synchronization of national support to large European research projects. In the area of research and innovation, commission launched "state aid for innovation" that includes promoting cross border research cooperation and public private research.[90]

The Lisbon Strategy pursues the aim of becoming a knowledge economy where the knowledge is defined as *"... knowledge, meaning R&D, innovation and education, is a key driver of productivity growth*."[91] This knowledge definition brings so much responsibility to the higher education as creating knowledge with some other stakeholder, transforming it to social and economic benefit. The recent attitude of EU institutions towards the funding of universities shows the increasing concern to the output and performance of higher education. In the Commission's Communication "*Delivering on the modernizationagenda for universities: Education, research and innovation"*of 2006, this relatively new attitude is explained as follows:" *Universities should be funded more for what they do than for what they are, by focusing funding on relevant outputs rather than inputs, ... Competitive funding should be based on institutional evaluation systems and on diversified performance indicators with clearly defined targets and indicators supported by international benchmarking".*[92]

The main problem about the business participation in research and innovation investments is stated as university-industry-public partnership and lack of regional and

[89]European Commission, (2002), **More Research for Europe Towards 3% of GDP**, COM (2002), 499 Final, p.3.
[90] European Commission, (2005b), p.6.
[91] European Council,(2005), **European Council 22 and 23 March 2005 Presidency Conclusions**, http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/84335.pdf(21.11.2011)
[92] European Commission, (2006), **Delivering on the Modernisation Agenda for Universities: Education, Research and Innovation**, COM (2006), 208 Final, p.7.

sectoral synergy. Current rules and implementation shows a similar fragmentation with tax incentives and a common perspective is needed. The basic strategy of the Commission is strengthening industries in terms of R&D activities and establishing new sectoral networks and improving the existing ones. Although, EU has many dynamic clusters, they are generally small and less integrated than the ones in USA. In order to improve this partnership, commission launched two complementary initiatives called "Europe INNOVA" which is *a family of sectoral innovation projects bringing together analysis and practical experience and facilitate networking between industrial clusters.*This initiative was designed on sectoral basis and provides solutions to barriers to innovation in each particular sector and also provides networks industrial clusters[93]

The maximum contribution of science and technology can be ensured when EU is able to get innovation to market and turn new ideas into productivity gains. Since 2005, more demand side measures began to be applied rather than supply-side actions such as R&D subsidies. In the 2nd Interim Report of Lisbon Expert Group, the demand oriented innovation policies are defined as *set of public measures to induce innovations and / or speed up diffusion of innovations through increasing the demand for innovations, defining new functional requirement for products and services or better articulating demand.*[94]The most applied demand side innovation policies are creating state demand by direct, strategic or co operative procurement and supporting private demand in the form of direct and indirect support

3.2.2.3. Creating More and Better Jobs

The main headline indicators for monitoring *the employment are the employment rate of 70% overall, of at least 60% for women and of 50% for older workers (55 to 64) by 2010, and to reduce unemployment and inactivity.*[95]In order to reach these goals and establish a growing labor market with strong social cohesion "Employment Guidelines" are established. Employment guidelines of European

[93] European Commission, **Better Regulation for** N**ew Technologies**, http://ec.europa.eu/invest-in-research/policy/regulation_tech_en.htm(21.11.2011)

[94] European Commission, (2007), "Towards Open and Systemic Research and Innovation Policies for Europe Trends in the National Reform Programmes", **2nd Interim Report of the Lisbon Expert Group,** p.23.http://ec.europa.eu/invest-in-research/pdf/download_en/leg_report2_final.pdf(21.11.2011)

[95] Employment Committee, (2009**), Employment Guidelines: Indicators for Monitoring and Analysis**, p.1.http://ec.europa.eu/social/BlobServlet?docId=3643&langId=en(21.11.2011)

Employment Strategy are proposed by the Commission and approved by the Council to be integrated with the other macroeconomic and microeconomic guidelines for three years after 2005. Under these guidelines, the Lisbon Strategy designed two complementary approaches: "Life-Cycle Approach" and "Flexicurity Approach". The former, aims to *attract more people into employment including disadvantaged and inactive people* and create a high level of employment as a sum and a well-balanced young-old and male-female worker distribution[96] while the latter is assumed to adopt traditional European Labor Market to the flexible and innovation based international business environment by providing investment in human capital, formal education and on-the-job-training to prepare workers to the rapidly changing business environment.[97]

The main challenges that the Lisbon employment strategy has to face with are the demographic ageing and the globalization. The employment level has to be increased although the working population is decreasing due to the ageing. Also, the policies trying to improve employment have to pay attention to the involvement old people and women to the labor market. On the other side, in a business environment that becomes significantly competitive, a right balance has to be established to protect both the employees and employers. [98]

3.2.3 Main Criticisms

Wim Kok report explains problem of Lisbon Strategy regarding the communication mechanism as the crowded agenda of the Strategy making it for members both to understand and focus on. In the report, this feature is expressed as "… *Lisbon strategy has become too broad tobe understood as an interconnected narrative. Lisbon is about everythingand thus about nothing. Everybody is responsible and thus no one. The endresult of the strategy has sometimes been lost."* According to the report, an ambitious and broad strategy like Lisbon must be clear enough to transform the message of what is done, why it is done and who is responsible.[99] The main governance mechanism of Open Method of Coordination, which is composed of peer pressure and

[96]European Council, (2008), **Council Decision on guidelines for the employment policies of the Member States**, 2008/618/EC, pp.4-19.
[97] World Economic Forum, (2008), p.5.
[98]Kok, Wim, (2004), p.32.
[99]Kok, Wim, (2004), p.16.

benchmarking, is criticised for including over a hundred indicators related with Lisbon process making vital objectives blur.In the report, 14 structural indicators that are established by Council are referenced and a league based on these indicators is suggested to be formed for *praising good performance and castigating bad performance — naming, shaming and faming.*

Another main criticism in the report is about lack of commitment and political will. One aspect of it is explained as too much tolerance against the delays and wrong practices in transposition and implementation of legislation by member states. Differences of legislation between member states is claimed to place unnecessary burden on business.[100] Regarding the commitment, report emphasizes the importance Europe beside national countries. According to the report, due to the lack of association with the Strategy, enough pressure on politicians, social partners and other stakeholders has not occurred towards reforms. Also, in order to reflect the priorities of the Strategy, High Level Group suggests reshaping EU budget towards main Lisbon goals such as R&D, infrastructure and education and training etc.[101]

In the report of an Independent High-Level Study Group chaired by Andre Sapir, Lisbon strategy is evaluated as one of the steps in economic integration in Europe. The approaches for managing economic policies are explained under four categories namely; delegation, commitment, coordination and autonomy. Delegation represents the policies that are decided and operated at EU level (competition policy etc.), while commitment is explained as member states have the main responsibility but they are subject to sanctions if they do not meet their obligations (budgetary policy) coordination is explained as the level where decision making and implementation is done by member states but subject to EU process of coordination (employment policies) and autonomy is valid for policies decided and implemented autonomously. Since the governance in practice is combination of different level of integration methods, it becomes harder to govern the system. Sapir Report claims that the poor economic is result of confusion and tension. Confusion is stated to be created by complexity of the

[100]Kok, Wim, (2004), p.24.
[101]Kok, Wim, (2004), pp. 40-42.

system and tension is explained as because of the gap between the goals of EU and the member states.[102]

Lisbon Strategy is explained as another step of the willingness for increasing integration. It is argued that Lisbon Strategy was supported by opposite groups with different aims. According to the report, some supporters believed that Open Method of Coordination (OMC) which is the main governance mechanism of Lisbon will encourage national level policies as an alternative to tight collective rules, however, some others recognized Lisbon similar with EMU or Single Market which brings new policies to the range of the Union. Sapir Report compared Single Market Programme of 1985 with Lisbon Strategy as explained the difference as follows:" Narrow intermediate objectives, precisely defined means and effective instruments have been replaced by broader objectives, softer means and weaker instruments". Since the Report is prepared in 2003, it avoided to express clear conclusion about Lisbon but emphasized the fact that so much is expected from the intermediate integration layers of commitment and coordination.[103]

Reports that are prepared by independent groups chaired by Wim Kok and Andre Sapir evaluated the mechanism of the first Lisbon Strategy before its revision in 2005. There are also other criticisms towards the Strategy even after Renewal.

In another article, Europe's R&D: Missing the wrong targets, Lisbon targets are criticized from two aspects. First, failure in reaching the goals is emphasized and second, putting common targets for member states is criticized by expressing the country differences. An eye-catching argument of the article is that, it focuses on government side of the R&D obligations and claims that despite the targets, many of the member states actually reduced their government funded R&D in the period of mid 1990s and 2005 which is not compensated by increase in business-funded R&D. It is stated that, government sector is still behind its target of 1% and putting targets to business sector is not reasonable without creating an integrated European market for technology (for ex: EU patent system) and removing prohibitive costs that private sector

[102]Sapir, Andre, (2003), **An Agenda for a Growing Europe: Making the EU Economic System Deliver**, pp.74-79.www.euractiv.com/ndbtext/innovation/sapirreport.pdf(21.11.2011)
[103]Sapir, Andre, (2003), pp.84-86.

faces. Also, the article states a positive relationship between a country's distance from the R&D target of 3% and the target it has set itself for 2010. this situation is interpreted as unrealistic rather than an expression of political will.[104]

Second criticism in the article is against the fact that industrial specialisation of the countries is not considered while evaluating country performances. It is argued that a country specialized in finance (eg. Luxemburg) or tourism, fashion, services, food etc. would not need a high level of R&D in order to experience high growth like a country specialized in pharmaceuticals, engineering or biotech industries. On this assumption and considering the differences in R&D intensity of different sectors, R&D performance of Finland which has a for specialisation in information and communication technologies is argued to be not as high as it is perceived. Another important argument in the article is stated as follows:" ... *business R&D intensity is endogenous, not exogenous. Governments should therefore go beyond traditional incentive policies such as direct R&D subsidies or tax credits*." Considering this fact, spending money to low-tech sectors for increasing R&D is stated to be an ineffective way which will lead to very little impact on aggregate efficiency. Increasing business contribution to R&D performance is stated to be based on two elements. First, integrated market is emphasized by emphasizing the relatin between market size and return on investment by giving the example of US which have a huge and homogenous market. Beside market size, spending on academic research is explained as another source of high performance market size is valid for US but not for Sweden. The relation between academic research and business research is explained as follows:" ... *universities generate new ideas which are then transferred to the private sector. The transformation of these ideas into products or processes requires further applied research activity and development*."[105]

Another report that mentions specialisation, like the article above, is Aho Group Report chaired by Mr. Esko Aho who is Former Prime Minister of Finland. The report suggests establishment of excellence centres which will imply a degree of

[104]Pottelsberghe, Bruno Van, (2008), "Europe's R&D: Missing the Wrong Targets", **Bruegel Policy Brief**, Vol. 2008/3, pp.2-6.http://www.bruegel.org/publications/publication-detail/publication/7-europes-r-and-d-missing-the-wrong-targets/(21.11.2011)
[105]Pottelsberghe, Bruno Van, (2008), p.7.

national specialisation by gathering successful scientists in particular areas.[106]Also, again in parallel with the article of Bruno van Pottelsberghe, disadvantage created by fragmented markets is explained as follows*:"... the reality for most innovators remains that they face an obstacle course of multiple levels of regulations and requirements, each of which raises costs and lowers incentives*." [107] Beside different regulation applied by governments, full mobility including human resources, finance and organisation and knowledge is expressed as necessity to have a united market. The main responsibilities of governments are explained as taking actions on regulation, standards, public procurement, intellectual property and fostering a culture which celebrates innovation.

In the "Lisbon Scorecard X:The Road to 2020", published by Centre for European Reform, performance of member states for reaching the main Lisbon targets are evaluated and graded. The report defines the "Heroes" and "Villains" as the best and worts performers of the member states in each policy area just like the classification in the next chapter in which the member states are categorized according to both their recent level and the improvement since 2000. The full ranking can be seen in the Lisbon Scorecard report, here the main criticisms of the report is summarized. The report claims that the weakness of the Strategy was not the *diagnosis* but the *lack of focus and the instruments available to meet the objectives*.[108]The Report provide suggestions for Europe 2020, which is the new agenda of EU which includes very similar objectives with the Lisbon Strategy[109], while criticizing the Lisbon Strategy. The first criticism, which is common with the reports above, is the absence of any mechanism, which is assumed to be directed by the Commission, that can enforce member states to fulfil their responsibilities. Lisbon Scorecard repeated the need for the mechanism "name and shame". But similar with the article Missing the Wrong Targets?, the Lisbon Scorecard also criticizes the "one size fits all" approach that puts the same priorities for all member states,[110]The second criticism of the Report is the ignorance of improvement of

[106] Aho, Esko, (2006), **Creating an Innovative Europe**, p.14. http://ec.europa.eu/invest-in-research/action/2006_ahogroup_en.htm(21.11.2011)
[107]Aho, Esko, (2006), p.5.
[108] Centre for European Reform, (2010), **Lisbon Scorecard X:The Road to 2020**, p.92.http://www.cer.org.uk/pdf/rp_967.pdf(21.11.2011)
[109]For further information on Europe 2020, see http://ec.europa.eu/europe2020/index_en.htm(21.11.2011)
[110] Centre for European Reform, (2010), p.94.

human capital and innovation and focusing on numerical objectives of R&D expenditures, It is stated that measures of innovation should be reviewed to be able to measure the innovativeness in the service sector which accounts two-thirds of EU GDP because introducing new business models is also a sign of being innovative which can not be understood by the traditional measures.[111]

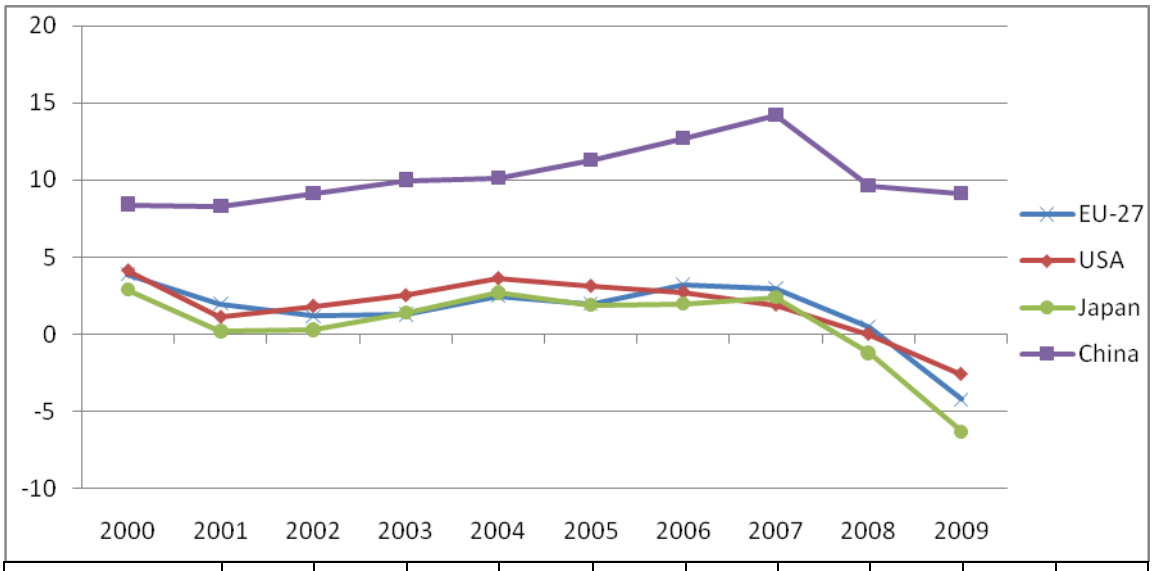
[111] Centre for European Reform, (2010), p.23-25.

CHAPTER 4: BENCHMARKING LISBON

4.1. MAIN MACROECONOMIC INDICATORS

At the beginning of Chapter 4, the main macroeconomic developments that led EU to establish the Lisbon Strategy are mentioned by referencing the performance of main rivals EU, USA and Japan in the basic indicators such as growth in GDP, employment and productivity and their levels in 2001 and it is concluded that Lisbon Strategy was established as a "framework" that covers the enlarging acquies on the competitiveness and industrial structure in order to close the gap mainly with USA. In this part, impact of the Lisbon Strategy in the same indicators is examined in order to see what Lisbon succeeded to reverse the negative trend in 1990s. While doing this, new players of the game such as Korea and China are also included in the analysis by considering the recent global conjuncture.

Figure 4.1: Growth of Real GDP in EU and its Main Rivals (1999 – 2009)

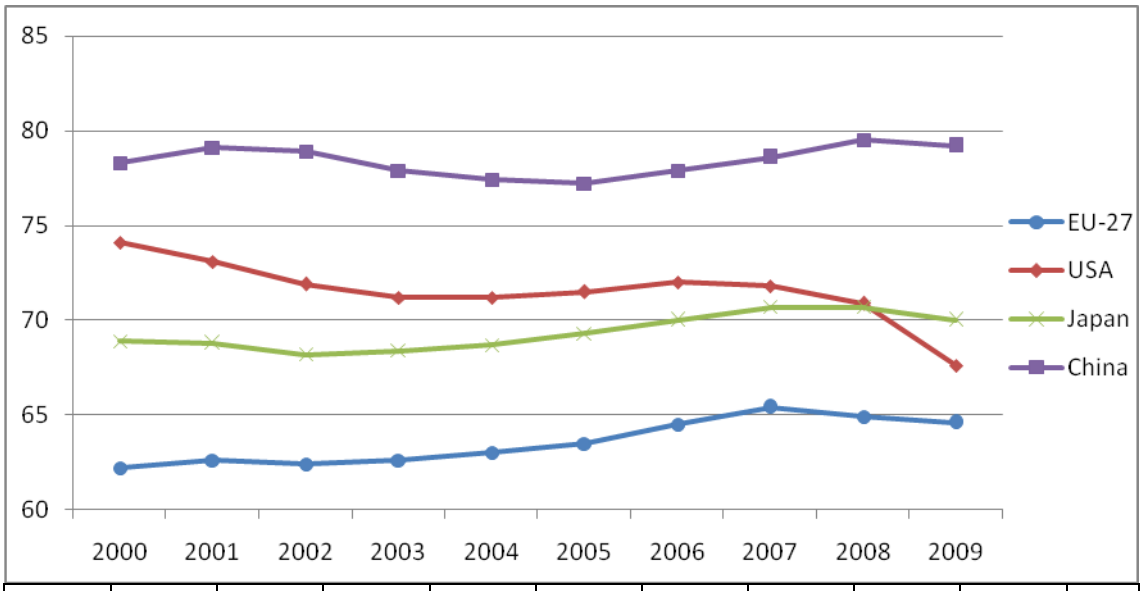


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EU-27	3,9	2	1,2	1,3	2,5	2	3,2	3	0,5	-4,2
USA	4,1	1,1	1,8	2,5	3,6	3,1	2,7	1,9	0	-2,6
Japan	2,9	0,2	0,3	1,4	2,7	1,9	2	2,4	-1,2	-6,3
China	8,4	8,3	9,1	10	10,1	11,3	12,7	14,2	9,6	9,1

Source: China:Worldbank Databank
http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?page=2
EU, Japan and USA: Eurostat Database
http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&plugin=1&language=en&pcode=tsieb020

In 1990s, GDP growth has been higher than EU but there has been an increasing trend in both parties. On the other hand, Japan has experienced a downward trend in the same period. When the GDP growth rates after 2000 in Figure 4.1 is considered, the first point is that all countries except China are deeply affected by the global crisis after 2008. China maintain its growth rate close to 10% despite the crisis. The trend in Japan, USA and EU has been very similar in this period with a stable trend in growth rates except until the crisis. It is seen in the figure than, EU showed a higher growth performance than Japan and close to USA when the average annual growth rates (AAGR) after 2000 are considered. When AAGR in the second half of the 1990s and after 2000 are compared it is seen that EU maintained the same growth performance in both periods while USA showed definitely lower growth rates.

Figure 4.2: Employment Rates in EU and its Main Rivals (1999 – 2009)



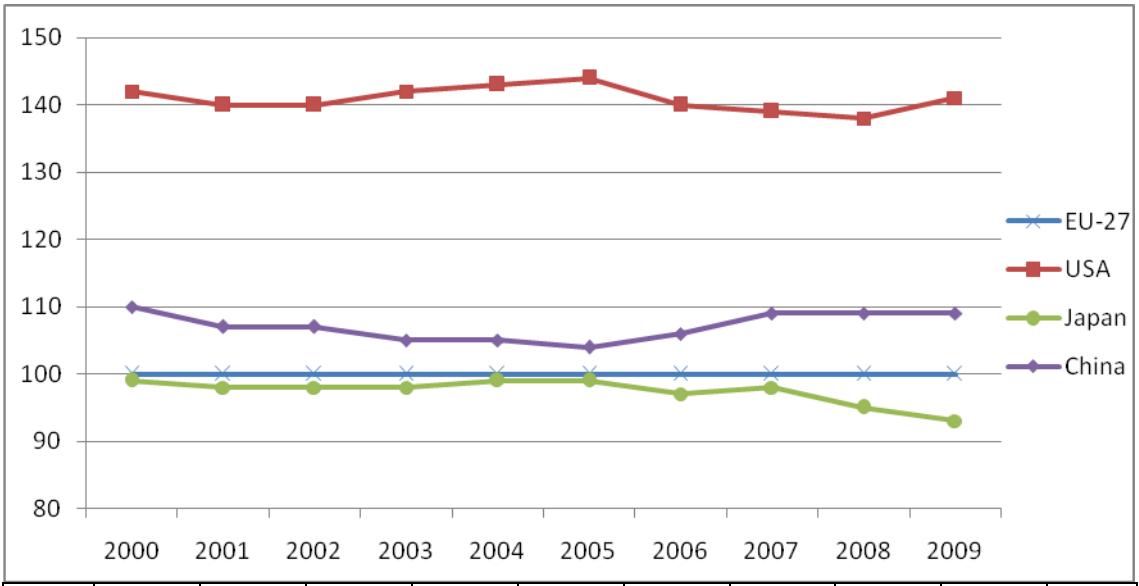
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EU-27	62,2	62,6	62,4	62,6	63	63,5	64,5	65,4	64,9	64,6
USA	74,1	73,1	71,9	71,2	71,2	71,5	72	71,8	70,9	67,6
Japan	68,9	68,8	68,2	68,4	68,7	69,3	70	70,7	70,7	70
China	78,3	79,1	78,9	77,9	77,4	77,2	77,9	78,6	79,5	79,2

Source: Eurostat, (2010b), p.100.

Figure 4.2 shows that the employment rates has shown a stagnating trend after 2000. Although USA has showed a growth trend higher than EU in the second half of the 1990s, USA could not maintain the same performance in 2000s and employment rate decreased to 71% in 2008 from 74% in 2000. In the same period, employment rate

has increased by 0,5% annually and reached to 64,9 after showing a peak in 2007. China and Japan showed a slightly incresing trend which is lower than EU after 2000. China is seen as the only country that is not affected by the global crisis in 2009. When the trends before and after 2000 are compared, it is seen that USA experienced a definite fall in terms of employment rates. On the other hand, EU and Japan showed low growth rates similar with the annual growth in 1990s. These trends resulted with the highest employment rate in China with over 79% following by Japan, USA and EU. The significant point is the fact that EU has the lowest employment rates despite the clear fall in USA. While anaylsing the performance of the countries, it should be noted that the flexible labor market in USA resulted with the highest fall in employment rate in 2009 and the gap with EU has narrowed but due to the same feature of labor markets, the gap will increase with the same pace after the crisis if EU shows the same trend.

Figure 4.3: Labour Productivity Rates in EU and its Main Rivals (1999 – 2009)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EU-27	100	100	100	100	100	100	100	100	100	100
USA	142	140	140	142	143	144	140	139	138	141
Japan	99	98	98	98	99	99	97	98	95	93
China	110	107	107	105	105	104	106	109	109	109

Source: Eurostat, (2010b), p.92.

As it is mentioned before, labour productivity rates in EU and Japan has increased faster than USA until 1990s. Especially in the second half of 1990s, USA showed a growth performance two times of EU and Japan. Figure 4.3 shows the trend

after 2000. It is seen that EU maintained its position against its main rivals in this period. Furthermore, it has increased labour productivity relatively to Japan.

The figures above analyzed the trends of main macroeconomic indicators in EU and its main rivals since the establishment of Lisbon Strategy. The 1990s had shown the rise of USA in terms of GDP growth resulting from employment and productivity. In the period after 2000, USA has lost its momentum. China showed an eye catching performance which is not disturbed even in the global crisis. Japan continued its slight growth performance in employment but not in productivity. EU has experienced an average employment and productivity growth and maintained its position before Japan and after USA despite the falling performance of USA. It is seen that EU could not succeed the desired jump in overall economic performance and Lisbon Strategy could not provide the projected momentum. Nevertheless, ignoring the global crisis in 2009 and considering the enlargement in 2004 which significantly changed the economic structure, it can be concluded that EU succeeded to maintain its position against its traditional rivals, USA and Japan but the rising Asian economies clearly outperforms than EU.

4.2. R&D INDICATORS

The Lisbon strategy covers a wide range of issues as it is mentioned in the previous chapter. The ambitious targets of making Europe a more attractive place to invest and work, applying knowledge and innovation for growth and creating more and better jobs without doubt requires actions in different areas of the economy. In order to measure the performance of the Strategy, some common and measurable indicators were needed that represents the overall performance as it is aimed in this study. In Win Kok report, the importance of benchmarking is explained as "… *are clear incentives for the Member States to deliver on their commitments by measuring and comparing their respective performance and facilitating exchange of best practice"* In the report, the way of benchmarking is suggested to be a league based on 14 structural indicators, determined by European Council in December 2003, and this process is summarized as *naming, shaming and faming.*[112]

[112]Kok, Wim, (2004), p.43.

In the Presidency Conclusions of March 2000 Lisbon European Council, it is stated that "*The European Council invites the Commission to draw up an annual synthesis report on progress on the basis of structural indicators to be agreed relating to employment, innovation, economic reform and social cohesion*."[113] Based on this invitation, Commission adopted a list of 35 indicators in 2000, 36 indicators in 2001 [114] and 42 indicators in 2002. In 2003, Commission prepared of a short list of 14 Structural indicators and proposed the list to Council for having a list that is *easy to understand* and *easier to present the picture*.[115] The list is, as amended by the European Council in December 2003, is shown in Table 4.1:

Table 4.1: Official Structural Indicators for Benchmarking Lisbon

Economic growth
1. GDP per capita Index
2. Labor productivity Index
3. Employment rate (by gender)
4. Employment rate of older workers (by gender)
5. Youth educational attainment (by gender)
6. Gross domestic expenditure on R&D
7. Comparative price levels Index
8. Business investment
Social Cohesion
9. At risk-of-poverty rate after social transfers (by gender)
10. Long-term unemployment rate (by gender)
Environment
11. Dispersion of regional employment rates (by gender)
12. Greenhouse gas emissions
13. Energy intensity of the economy
14. Volume of freight transport relative to GDP

Source: European Commission, (2004b), "Delivering Lisbon: Reforms for the Enlarged Union", **Report from the Commission to the Spring European Council**. COM (2004), 29 Final, pp.29-63.

[113]European Council, (2000), p.12.
[114]European Commission, (2001b), **Structural Indicators**, COM (2001), 619 Final, p.3.
[115]Euroean Commission, (2003b), **Structural Indicators**, COM (2003), 585 Final.p.3.
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0585:FIN:EN:PDF(21.11.2011)
.

Beside the official structural indicators, different measures have been used in various studies and reports due to alternative point of views and focuses. For example, the Integrated Guidelines (1-16) added "GERD financed by industry", "High-tech exports", "Patents – EPO", "Level of Internet access by Households", and "Science and technology graduates" to measure innovation level and its reflections on economy. Also, relating the employment variables such as "Market integration" and "Business demography – survival rate of enterprises" etc. have been monitored.[116]European Innovation Scoreboard, on the other hand, applies an input- output separation by defining input variables under 3 headlines: innovation drivers, knowledge creation, and innovation entrepreneurship. The output variables are examined under the titles of applications and intellectual property.[117]EU commission also publishes "European Innovation Scoreboard" under "European Trend chart", "EU Industrial R&D Investment Scoreboard" and "Science, Technology and Competitiveness Key Figures" reports including both overlapping and alternative indicators. The OECD publishes two reports called "OECD, Main Science and Technology Indicators "and "OECD, science technology and industry scoreboard "including more detailed indicators and analysis.In Eurostat Statistical Database, it stated that "*Eurostat statistics on R&D expenditure and personnel are compiled using the guidelines laid out in the Frascati Manual published in 2002, by OECD."*[118]In this study, the sectoral separation is done by referencing the Frascati Manual. In addition to the reports of formal institutions, in order to focus on the economic aspects innovation variables and their effects on international competition, a ranking on several subjects have been used by examining composite indicators in two reports, "The Global Competitiveness Report" and "Lisbon Review" prepared by the economists of World Economic Forum including hard data and business surveys.

To analyze the performance of European countries for reaching the Lisbon targets related with Science and Technology Policies and their reflections on the economy, the common and comprehensive indicators are chosenfrom the long list of indicators mentioned above. While measuring the performance of science and

[116]Employment Committee, (2009), pp.4-5.
[117] EU Commission, (2008a), "European Innovation Scoreboard 2007", **Pro Inno Europe Papers,** No:6, p.35.http://www.proinno-europe.eu/page/european-innovation-scoreboard-2007(21.11.2011)
[118] Eurostat, **Statistics on Research and Development: Reference Metadata**.http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/rd_esms.htm(21.11.2011)

innovation policies in Lisbon Strategy, some critical points have been considered. First of all, it is a fact that the aim of becoming knowledge based economy brought difficult targets for research agenda leading to the debate of suitability of the targets and the criticism for one-fits-all policies and as a result, lack of national ownership. The criticism towards thetargets of the Lisbon generally states that the one-size-fits-all approach was neither broken down into individual national targets, nor did it take account of the starting positions of Member States or their comparative advantages although the number of headline targets were reduced in the 2005 review. Also, the Lisbon Strategy was not implemented in an isolated world. Since the establishment of the Strategy, EU experienced its largest expansion and hit by a global crisis. So it would be too simplistic to conclude that the strategy has failed because these targets were not met.[119]

The research and development policies can be monitored from a complementary perspective by observing both the input and output variables because the ability to translate innovation inputs into innovation outputs determines the contribution of R&D to economic objectives. Most common and basic input and output variables observed in the resources above are chosen for the analysis.The mostly used input variables are R&D expenditures and human resources employed and the output variables are high technology exports and patents. While observing the input indicators, the contribution of public and private sectors toR&D efforts in terms of expenditures and human resources will be highlighted. The reason for common usage of R&D expenditures in comparisons is the relative ease of comparison across sectors and countries and availability of detailed data. In the analysis below, it should be noted that R&D expenditure as an input variable can not measure the effectiveness of R&D or it can not be an indicator of sufficient level of expenditure to translate an innovation to final product.[120] That is why the performance of countries in output variables are also observed in the analysis. The analysis requires two aspects going from the pig picture to individual member states. In the analysis of both input and output variables, first, the progress in EU and its main rivals namely USA, Japan, Korea and China areobserved.

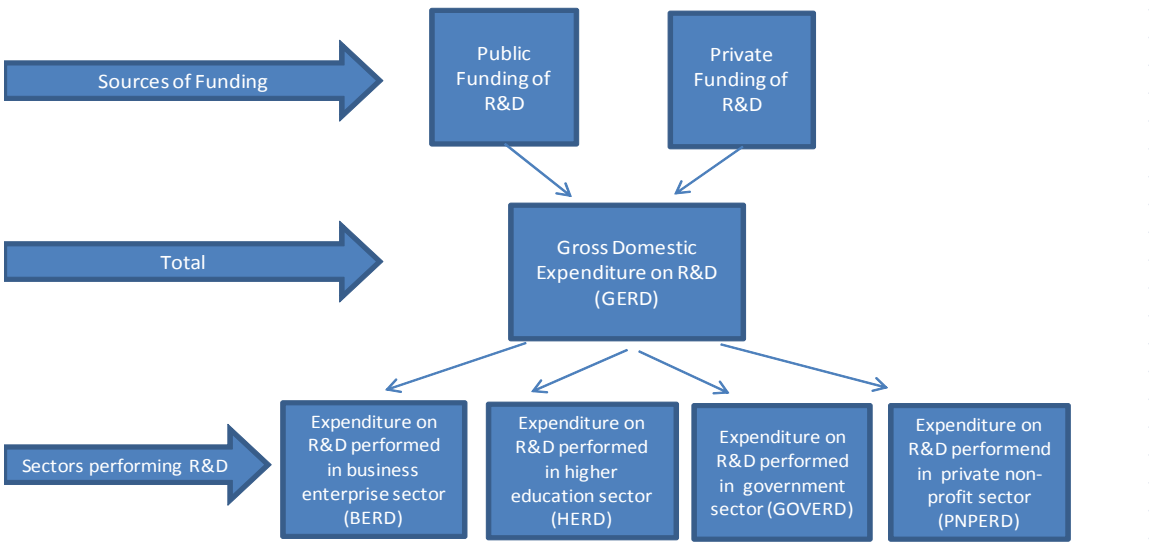
[119]European Commission, (2010b), "Lisbon Strategy Evaluation Document", **Commission Staff Working Document**, SEC (2010), 114 Final, p.2.
[120] Hughes, Kirsty, (1986), **Exports and Technology**, Cambridge University Press, p.5.

Secondly, the member states and Turkey are observed by regarding the recent level and the progress made. The counties are classified under four headings as *falling further behind (low level – low progress) catching up (low level – high progress), losing momentum (high level – low progress) and pulling further ahead (high level – high progress).*By doing so,relatively positions and the progress towards the targets set in Lisbon Agenda are observed while emphasize is given to the developments in member states that have similar economies with Turkey.

4.2.1. Investment in Research

As mentioned in Part I, Research and experimental development (R&D) covers "*creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications."*The sectoral classification of Frascati Manual is applied in this study and the R&D expenditures are separated into the sectors namely government, private sector, higher education and private non-profit organizations.

Figure 4.4: Sectoral Classification of R&D Funding and Expenditures



Source: Eurostat, (2010a), p.29.

As it is seen in Figure 4.4, the main separationsof the R&D indicators are based on the *performance* and *funding* of the R&D. The total R&D expenditure in an economy is called GERD which is *financed* by government (GBAORD)* and private sector.

GERD is *performed* by business enterprise sector, higher education, government and non private sector. In order to focus on the main Lisbon targets, gross domestic expenditıre on R&D (GERD) and business expenditure on R&D (BERD) are observed in this study. As it is mentioned before, the Lisbon target for GERD set as 3% of GDP and private sector is requested to cover 2/3 of the overall expenditures.

4.2.1.1 Gross Domestic Expenditure on R&D (GERD)

In Figure 4.5,the trend of the gross domestic expenditure (GERD) after 1998 is shown. The big picture reveals two main developments in the last decade. First one is the entrance of new players to the game which leads to the so called 'multi-polar world'. Second is the diminishing or stagnating investment levels for EU and US that accelerates the rise of Asia. When the OECD countries are considered, it is seen that the increase in GERD was higher in late 1990s, with a level of 4,6 % annually (in real terms) between 1995 and 2001, but the growth rate was less than 2,2 % between 2001 and 2005. R&D expenditures in EU, Japan and US showed similar pace since mid 1990s with an increase rate around 2,9 % a year in real terms and their share of R&D expenditures in OECD area did not show a significant change.[121] The performance of China and Korea is worth mentioning in the figure. China, with an annual growth rate of 12% in the last decade, is recently competing with EU and with the same growth rates, it is expected to reach the level of EU in the near future. Due to the high level of competition and the rising Asian countries, the share of EU in the world in terms of R&D expenditures is decreasing. EU's world share in GERD diminished by 7,6 % over 6years meaning that 75 % of gross domestic expenditure on R&D (GERD) is executed in other world regions.[122]

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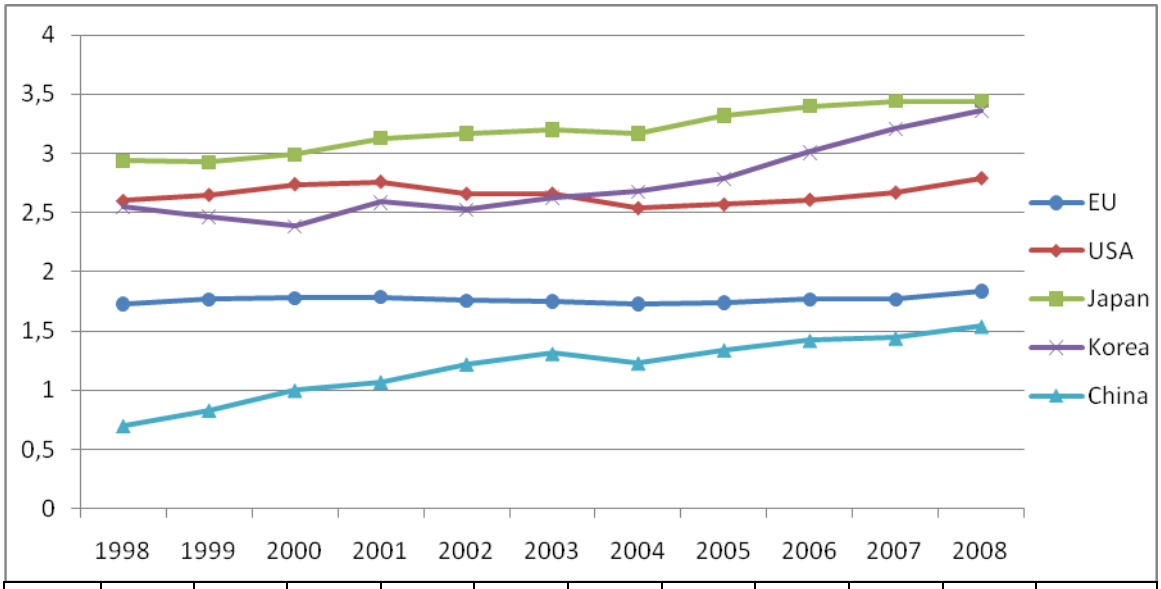
[121] OECD, (2007), **Science, Technology and Industry Scoreboard 2007: Innovation and Performance in the Global Economy**, p.24.http://www.oecd.org/dataoecd/43/24/40305816.pdf(21.11.2011)
*GBAORD is a tool to examine the government support and represents budget provisions rather than the actual expenditure. Due to some handicaps of GBAORD in data harmonization resulting from the different usage in national practices it is not used in the study.

[122] European Commission, (2008b), **A More Research-Intensive and Integrated European Research Area: Science, Technology and Competitiveness Key Figures Report 2008/2009**, p.6.http://ec.europa.eu/research/era/pdf/key-figures-report2008-2009_en.pdf(21.11.2011)

Figure 4.5: GERD in EU and its Main Rivals between 1999 – 2009 (% of GDP)



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU	1,73	1,77	1,78	1,79	1,76	1,75	1,73	1,74	1,77	1,77	1,84
USA	2,6	2,65	2,74	2,76	2,66	2,66	2,54	2,57	2,61	2,67	2,79
Japan	2,94	2,93	2,99	3,13	3,17	3,2	3,17	3,32	3,4	3,44	3,44
Korea	2,55	2,47	2,39	2,59	2,53	2,63	2,68	2,79	3,01	3,21	3,36
China	0,7	0,83	1	1,07	1,22	1,31	1,23	1,34	1,42	1,44	1,54

Source: OECD Main Science and Technology Indicators.http://www.oecd.org/

These statistics show that some developing Asian countries are not solely depending on low-cost production. In 2003, China has become the world's main exporter of computers. Regarding electronics and telecom, China has been ahead of the EU since 2004. The rapid economic development of these countries is supported by increasing level of R&D investment which transforms the development into long term sustainability.[123]

Regarding the Lisbon target of %3, the Picture is not different. The current levels of %2 require so ambitious targets for member states with very strong commitment. As of 2007, 26 Member States have set targets for their GERD which are not to be essentially reached in 2010. Bulgaria is the only MemberState which does not have a target. If these targets had been reached, the EU R&D intensity would have reached, as it was planned, to 2,6% in 2010 but it could not be succeeded.

[123]OECD, (2007), p.7.

Table 4.2 shows the level of GERD in 2009 and the annual growth rate of R&D expenditures in the selected countries in the period of 1999-2009. The countries pulling further ahead are Finland, Denmark and Austria with a high growth performance of annual growth rate and GERD around 3% while Germany is also have a growth trend and following the first three countries. On the other hand, Sweden and France are the member states loosing ground with a GERD of 3,6% and 2,2% due to low growth performance. When the catching-up countries are observed, it is seen that Estonia and Portugal show the highest performance with an annual growth rate over 10%. Following these countries, Turkey, Spain, Lithuania and Hungary are the other main catching-up countries with a growth around 7%. Greece and new accession countries such as Slovakia, Bulgaria and Poland are the countries falling back with a negative growth. Also, Netherlands, as a one of the big economies in EU, shows a decreasing trend. United Kingdom is another big economy in this group with an annual growth of 0,27% which lower than the EU average of 0,98%.

Table 4.2: AAGR of GERD in MemberStates and Turkey between 1999 – 2009 and GERD in 2009 (% of GDP)

		2009	AAGR (1999-2009)
	European Union	2,01	0,98
Pulling Further Ahead (High Level - High Progress)	Finland	3,96	2,49
	Denmark	3,02	3,85
	Germany	2,82	1,75
	Austria	2,75	4,47
Losing Momentum (High Level - Low Progress)	Sweden	3,62	0,11
	France	2,21	0,23
Catching Up (Low Level - High Progress)	Slovenia	1,86	3,58
	Ireland	1,77	5,00
	Portugal	1,66	14,06
	Czech Republic	1,53	3,42
	Estonia	1,42	10,88
	Spain	1,38	6,05
	Italy	1,27	2,45
	Hungary	1,15	7,16
	Turkey	0,85	8,09
	Lithuania	0,84	6,80
	Malta	0,54	4,00
	Romania	0,47	1,75
	Latvia	0,46	2,78
Falling Further Behind (Low Level - Low Progress)	Poland	0,68	-0,14
	Bulgaria	0,53	-0,36
	Slovakia	0,48	-2,73
	Belgium	1,96	0,10
	United Kingdom	1,87	0,27
	Netherlands	1,84	-0,61
	Luxembourg	1,68	0,20
	Greece (2007)	0,58	-0,42

Source: Eurostat Statistics Database.http://epp.eurostat.ec.europa.eu(21.11.2011)

One striking point about Table 4.2 is the lack of an overall trend of R&D expenditures in EU member states. There exist very different growth performances which are not solely determined by the economic development of the countries. For example, United Kingdom and Netherlands are included in the falling further back countries while Lithuania and Hungary are showing a high growth performance over 6% a year.The focus here should be given to the performance of these countries and Turkey.

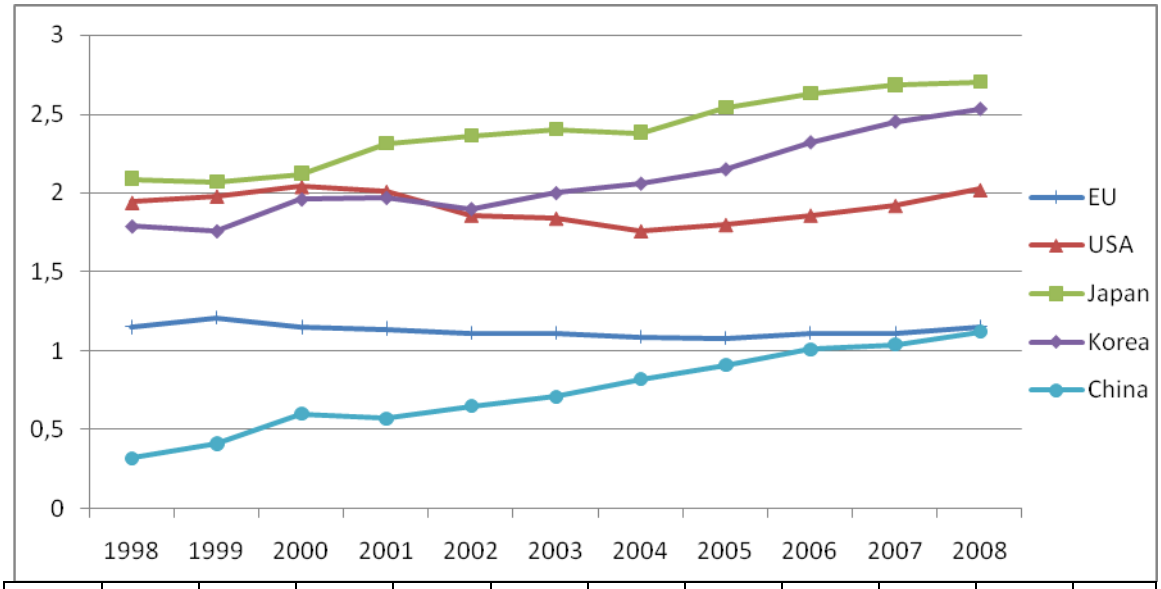
The new member states namely, Lithuania, Romania, Cyprus, and Latvia showed a remarkable performance with a R&D growth around 6%. In contrast, countries including Slovakia, Hungary, Greece and Poland felt further behind in the same period. The high number of member states under the average and significant differences in the country positions can be concluded as the weaknesses of the Strategy. The table below summarizes the countries with different level of performance that mentioned above.

4.2.1.2. Business Expenditure on R&D (BERD)

In the Presidency Conclusions of Barcelona European Council, it is stated that *"In order to close the gap between EU and its major competitors…overall spending on R&D and innovation in the Union should be increased with the aim of approaching 3% of GDP by 2010. two-thirds of this new investment should come from the private sector*" [124]Figure 4.6 shows how EU and its competitors performed regarding the contribution of private sector to R&D and innovation and the whether the goal set in the Barcelona Summit it accomplished. While observing the BERD performance it should be noted that R&D performance of business sector is a difficult subject to manage and improve. One significant feature is its relation with the overall economic conjuncture. There is a positive correlation between the business cycle developments and the business sector R&D funding. The data shows that BERD has not increased in EU and USA during the last decade. On the other hand, Korea, China and Japan showed a good performance regarding Business R&D expenditures**.**

[124] European Council, (2002), **Barcelona European Council 15 and 16 March 2002 Presidency Conclusions**, p.20. http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/71025.pdf(21.11.2011)

Figure 4.6: BERD in EU and its Main Rivals between 1999-2009 (% of GDP)



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU	1,15	1,21	1,15	1,14	1,11	1,11	1,09	1,08	1,11	1,11	1,15
USA	1,94	1,98	2,04	2,01	1,86	1,84	1,76	1,8	1,86	1,92	2,02
Japan	2,09	2,07	2,12	2,31	2,36	2,4	2,38	2,54	2,63	2,68	2,7
Korea	1,79	1,76	1,96	1,97	1,9	2	2,06	2,15	2,32	2,45	2,53
China	0,32	0,41	0,6	0,57	0,65	0,71	0,82	0,91	1,01	1,04	1,12

Source: OECD Main Science and Technology Indicators.http://www.oecd.org/

In the report of Commission, "Lisbon Strategy evaluation Document2010", the obstacles against the business are explained as follows:" … *the EU's key challenge remains making it more attractive for the private sector to invest in R&D in Europe rather than in other parts of the world. This means improving framework conditions* (*e.g. the single market, education and research systems,…*)". The report defines the main efforts to overcome these problems as the actions taken under the European Institute for Technology which aims to "get innovation to market" and the increased focus on demand side policies (explained in Lisbon Strategy chapter). But the progress in these initiatives is limited. For example, the regulations on patenting and system of standards are fragmented and too slow. Also the demand driven instruments such as public procurement has not reached to its full potential. [125] Due to the problems mentioned above, the business contribution to R&D has stagnated in EU.

[125] European Commission, (2010b), p.13.

Table 4.3: AAGR of BERD in MemberStates and Turkey between 1999-2009 (% of GDP)

		2009	AAGR (1999-2009)
	European Union	1,25	0,59
Pulling Further Ahead (High Level - High Progress)	Austria	1,94	5,09
	Denmark	2,02	4,33
	Finland	2,83	3,1
	Germany	1,92	1,5
Losing Momentum (High Level - Low Progress)	France	1,37	0,07
	Sweden	2,55	-0,41
	Belgium	1,32	-0,5
	Luxembourg	1,24	-2,11
Catching Up (Low Level - High Progress)	Lithuania	0,2	90
	Malta	0,34	38,57
	Portugal	0,78	38,75
	Estonia	0,64	30
	Latvia	0,17	18,33
	Hungary	0,66	14,44
	Turkey	0,34	8,89
	Slovenia	1,2	6
	Spain	0,72	6
	Bulgaria	0,16	4,55
	Ireland	1,17	3,45
	Italy	0,65	3
	Czech Republic	0,92	2,96
Falling Further Behind (Low Level - Low Progress)	United Kingdom	1,16	-0,49
	Greece (2007)	0,16	-0,59
	Netherlands	0,88	-2
	Poland	0,19	-3,45
	Romania	0,19	-3,67
	Slovakia (2008)	0,2	-5,12

Source: Eurostat Statistics Database.http://epp.eurostat.ec.europa.eu(21.11.2011)

Beside the overall picture, again, the progress made by the member states should be observed for the business R&D expenditures.Table 4.3 shows that the countries with the highest BERD shows a significant growth performance. The annual growth for BERD is around 4% for Finland, Denmark and Austria while the EU average is 0,59%. On the other hand, Luxembourg, Sweden and Belgiumare loosing ground

very rapidly with a negative growth while France is stagnating. Just the opposite of pulling ahead countries with a high growth performance, the countries falling behind show a clear decrease. New accession countries such as Slovakia, Poland, Romania and Greece show a negative growth around 4% while BERD decreased by 2% in Netherlands.

When the performance of countries in GERD and BERD are analyzed together, it is seen that the structure of the economy type of R&D expenditures and a country with a good performance in GERD may not show the same performance in business sector expenditures.For example, Bulgaria is one of the catching-up countries in terms of BERD however, regarding GERD, it shows a clear decrease.on the other hand, some countries show a parallel trend in both expenditures. Denmark, Austria and Finland are the countries with the highest performance in terms of both expenditures and new accession countries such as Poland, Romania and Slovakia have a definite decreasing trend.

4.2.2. Human Resources in Research

As it is mentioned in the Chapter 2: R&D and Competitiveness,Frascati Manual establishes international standards for measuring R&D activities by taking into consideration views of OECD, UNESCO, the European Union and various regional organisations.[126]

In the Frascati Manual, human resources in science and technology are stated as *R&D Personnel* which is defined *as all persons employed directly on R&D, as well as those providing direct services such as R&D managers, administrators, and clerical staff*.[127]

The Manual classifies R&D personnel as *Researchers,Technicians and equivalent staff* and *Other supporting staff*but the most important sub population is the researchers who are defined as *professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management*

[126]OECD, (2002), p.3.
[127]OECD, (2002), p.92.

of the projects concerned while other groups include skilled and unskilled staff participating in R&D activities under the supervision of researchers.[128]

R&D is a primary work in an R&D laboratory while it is a part-time activity for university teachers or postgraduate students. Ignoring this fact may lead to under or over estimation in measurement. In order to avoid such a methodological error, human resources is separated as;[129]

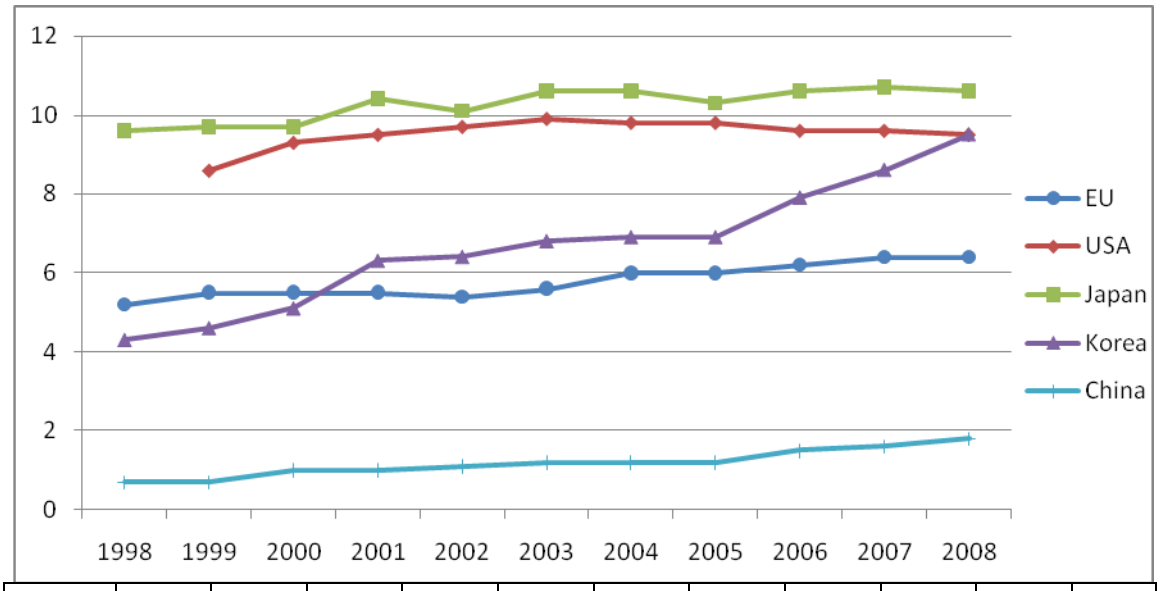
- Headcounts (HC): the total number of persons who are mainly or partially employed on R&D

- Full-time equivalence (FTE): one year's work by one person employed full time. (for example, a person who normally spends 30% of his/her time on R&D and the rest on other should be considered as 0.3 FTE.)

Figure 4.7 shows the number of researchers per thousand labor force in EU, its main rivals ans Turkey since 1998. It is seen that for all countries observed, the number of researchers have showed an increasing trend.The progress has been limited in EU, Japan and USA considering the growth rates but regarding the recent levels, EU is clearly in a worse position than the other two countries because Japan and USA are the leaders by a large margin.The performance of Korea is worth mentioning in the last decade. Korea has doubled the number of researchers per thousand labor force and reached the level of USA. although, China and Turkey experienced a higher performance their recent level is still very low. Still, the progress is promising.

[128]OECD, (2002), pp.93-94.
[129]OECD, (2002), pp.98-100.

Figure 4.7: Number of Researchers per 1000 Labour Force in EU and its Main Rivals (1998-2008)



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU	5,2	5,5	5,5	5,5	5,4	5,6	6	6	6,2	6,4	6,4
USA		8,6	9,3	9,5	9,7	9,9	9,8	9,8	9,6	9,6	9,5
Japan	9,6	9,7	9,7	10,4	10,1	10,6	10,6	10,3	10,6	10,7	10,6
Korea	4,3	4,6	5,1	6,3	6,4	6,8	6,9	6,9	7,9	8,6	9,5
China	0,7	0,7	1	1	1,1	1,2	1,2	1,2	1,5	1,6	1,8

Source: OECD Main Science and Technology Indicators.http://www.oecd.org/

Regarding the growth in the number of researchers per thousand labor force in the period of 2000-2006, Table 4.4 shows that the highest growth is observed in Malta, Czech Republic and Denmark but only Denmark has exceeded the EU average. The main catching up countries are seen as Malta, Czech Republic Turkey and Greece while the countries clearly falling further behind can be stated as, Latvia, Netherlands and Bulgaria. On the other hand, Denmark, Luxembourg and Austria and Slovenia are pulling further ahead with a high growth performance and a level over the EU average. When the performance of Slovenia in R&D expenditures and human resources is considered, its performance taking attention as one of the new accession countries.The countries loosing ground Finland, Germany and Switzerland..Turkey is one of the catching up countries with a very low starting point and an annual growth rate of 9,6

Table 4.4: AAGR of Number of Researchers in MemberStates and Turkeybetween 2000-2006 and Number of Researchers in 2006 (per 1000 labour force)

		2006	Annual Growth (2000-2006)
	EU-27	5,6	1,9
Pulling Further Ahead (High Level- High Progress)	Denmark	9,8	7,7
	Luxembourg	11,4	4,4
	Austria	7,4	4,4
	Slovenia	5,7	4,1
	Sweden	11,7	2,9
	Ireland	5,7	2,9
	France	7,4	2,1
	UK	6,2	2
Losing Momentum (High Level- Low Progress)	Belgium	7,4	0,8
	Germany	6,8	0,7
	Finland	15,3	-1,7
Catching-up (Low Level - High Progress)	Malta	2,9	14,1
	Czech Republic	5,1	11
	Turkey	1,6	9,6
	Greece	4,1	5,3
	Estonia	5,1	3,9
	Italy	3,4	3,7
	Portugal	3,8	3,5
	Spain	5,4	3,4
	Hungary	4,1	2,7
	Slovakia	4,4	2,4
	Romania	2,1	2,3
Falling Further Behind (Low Level - Low Progress)	Poland	3,5	1,7
	Lithuania	5,1	1,5
	Bulgaria	3	1,2
	Netherlands	5,3	0,4
	Latvia	3,5	-0,2

Source: European Commission, (2008d), p.53.

The researchers can be divided into three main subgroups according to the sector they belong as business enterprise, government and higher education researchers by applying the same categorization with the financing and performance of R&D

expenditures are being examined. In OECD area, the business enterprise researchers have the largest population despite the regional differences. In 2002, 64% of the all researchers worked in business sector while this ratio was 80% in US, 67% in Japan and 49% in EU25. Some estimates claim that EU will need 700 000 additional researchers, mostly in business sector, to reach its 3% target.[130] The statistics show that within EU-27, the share of business enterprise sector ranges from 10,9 % in Lithuania to 73,9 % in Luxembourg. Member States above the level of 60 % are Denmark, Germany, Luxembourg, the Netherlands, Austria and Sweden. Countries below 30 % are Bulgaria, Estonia, Greece, Cyprus, Latvia, Lithuania, Poland, Portugal and Slovakia. Since 2001, the number of business researchers (FTE) has been growing higher than the business expenditure on R&D resulting with decreasing R&D expenditure per researcher.[131]

Due to different features of national economies, the allocation of researchers shows significant differences. Countries such as Mexico, Turkey, Portugal, Greece, Poland and the SlovakRepublic have very low number of business researchers which is explained by the fact that *the business sector plays a much smaller role in the national innovation system than the higher education and government sectors.*[132]In OECD area, , the number of higher education researchers increased to 430000 from 350000 between 1997 and 2003. In contrast, the number of government researchers declined from 10% of the total research population in 1991 to 8% in 2002 across OECD, despite the fact that in many eastern European countries they still have a significant share.[133]

In OECD area, the increase in the number of researchers is higher than the total R&D personal which is explained by the increased number of postgraduates in the high education sector defined as researchers and also by the fact that more use of ICT causes less need for technicians and support staff per full-time equivalent researcher. But in the countries like New Zealand, Turkey, Mexico, South Africa, Greece, Netherlands, an inverse trend was observed.[134]

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[130] OECD, (2006), **Science, Technology and Industry Outlook 2006**, p.34.http://www.oecd.org/document/62/0,3746,en_2649_34273_37675902_1_1_1_1,00.html(21.11.2011)
[131]European Commission, (2008b), p.54.
[132]OECD, (2007), p.56.
[133]OECD, (2006), p.35.
[134]OECD, (2007), p.54.

4.2.3. High Technology Exports

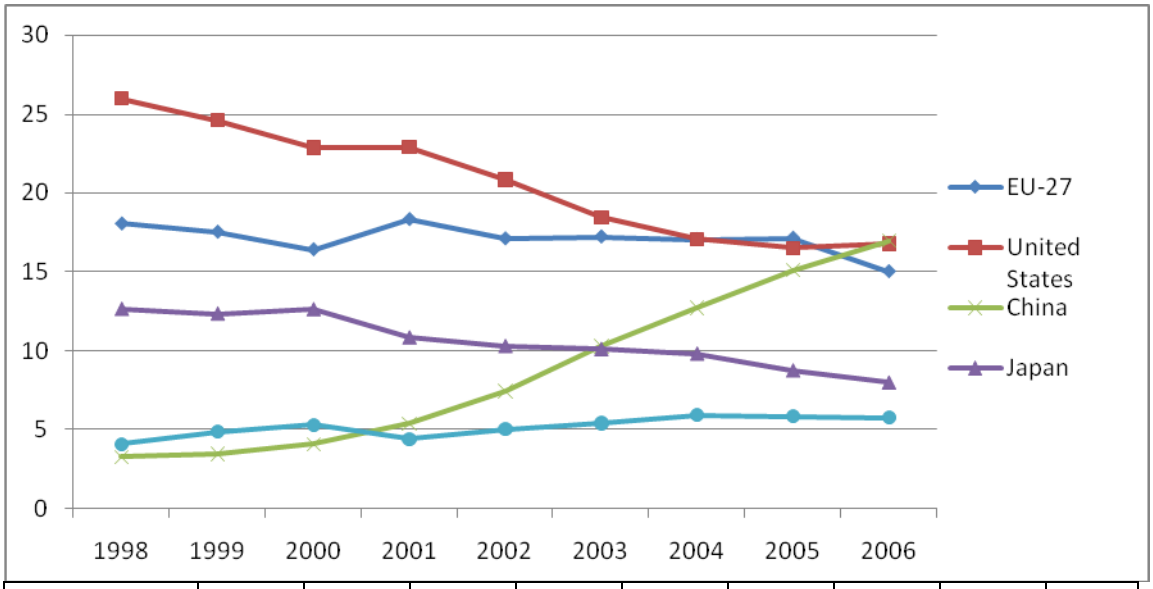
The share of technology-intensive sectors in the economy is a useful indicator of the transformation capability from knowledge to industry. The competitive power of the country is based on the success of this transformation that is consists of *creating new technologies, finding applications for them and pulling them on the market.*[135] The input and output indicators of R&D activities shows how successful are the countries in this process. In this part of the analysis, the output indicators are examined to measure the real impact of the R&D related activities in economic output and competitiveness.

High tech sectors are crucial in the competitiveness of the economy because they are more suitable for *gaining larger markets shares, creating new markets for products and using resources more efficiently; leading to high-value added production and bringing higher returns to the workers the employ, creating spill-over effect to the overall economy.*[136] The performance of countries in high technology trade is frequently used in monitoring international competitiveness. The high tech trade represents the exports and imports of the high technology products classified by Standard International Trade Classification (SITC) categorization developed by the United Nations Statistical Commission to classifydata on trade in products.*

Figure 4.9 shows the high technology exports of EU and major rivals after 1998. It is seen that USA and Japan have lost ground in global markets in the last decade very rapidly. EU has stagnated after 2000 until its share began to diminish again in 2006. One point in the figure is the Korea's performance in terms of high technology exports. Although Korea increased GERD and BERD very rapidly, it could not gained market share with the same pace. On the other hand, china showed a great performance regarding the transformation of R&D expenditures to high technology products. China increased its GERD two times and BERD three times, however, its share in high technology markets increased five times. This trend is reverse for Korea.

[135] Eurostat, (2010a), p.219.
[136] Eurostat, (2010a), p.219.
*For further information on SITC, see http://unstats.un.org/unsd/class/family/default.asp(21.11.2011)

Figure 4.8: Exports of High Technology Products in EU and its Main Rivals between 1998-2006 (World Market Share in %)



	1998	1999	2000	2001	2002	2003	2004	2005	2006
EU-27	18,08	17,55	16,43	18,36	17,13	17,25	17,08	17,17	15,03
United States	25,96	24,61	22,88	22,9	20,86	18,46	17,09	16,54	16,8
China	3,31	3,5	4,09	5,4	7,45	10,28	12,7	15,11	16,94
Japan	12,68	12,39	12,66	10,88	10,34	10,15	9,86	8,8	8,03
South Korea	4,11	4,9	5,32	4,41	5,05	5,44	5,94	5,88	5,79

Source: Eurostat Statistics Database.http://epp.eurostat.ec.europa.eu(21.11.2011)

In 2007, the EU-27 wasthe largest high-tech importer in the world, with a share of22,7 %, followed by the United States (20,1 %) and China(13,2 %). These three countries are both the largest exporters and importers but in a different order.[137] When the world high tech exports are observed in more details, it is seen that the rise of China is specifically based on computers (world's number one exporter) and electronics and telecoms (second). The world market for pharmaceuticals shows that EU, with its share of 46% in 2005, is the leader and doubles the level of US. This is because this sector is still dominated by mainly EU, US and Switzerland while China is slowly increasing their export volume.[138] On the other hand, some argues that while analyzing high-tech exports specific separations should be made. Some ICT goods which are defined as high tech products have become mass production process with low skilled labor. For

[137] Eurostat, (2010a), p.227
[138] OECD, (2007), pp.56-57.

example, China experiences competitive advantage over the manufacturing process in some products. However, sectors like aerospace involve more complex production processes, which require a highly qualified labor force.[139]

Table 4.5: AAGR of High Technology Exports in MemberStates and Turkey between 1999-2009 and High Technology Exports in 2009 (World Market Share in %)

		2007	AAGR (1998-2007)
	EU-27	1,25	13,2
Pulling Further Ahead (High Level - High Progress)	Belgium	1,406	16,1
Losing Momentum (High Level - Low Progress)	Germany	8,445	11,2
	Netherlands	4,954	11,1
	Ireland	1,539	9
	Italy	1,476	7,4
	France	4,229	7
	United Kingdom	3,495	3,2
Catching Up (Low Level - High Progress)	Slovakia	0,144	33,8
	Czech Republic	0,852	29,7
	Poland	0,21	22,7
	Hungary	1,003	21,4
	Greece	0,055	18,8
	Turkey	0,091	17,9
	Slovenia	0,068	13,7
Falling Further Behind (Low Level - Low Progress)	Austria	0,895	12,3
	Portugal	0,165	11,9
	Spain	0,528	10,9
	Estonia	0,042	8,9
	Finland	0,776	8,9
	Denmark	0,593	8,5
	Luxembourg	0,357	6,2
	Sweden	1,151	4,5

Source: Eurostat, (2010a), p.230;OECD, (2009), p.87.

[139] European Commission, (2008b), p.78.

The second aspect of the analysis on high technology exports examines the trend in the member states and Turkey. In Table 4.5, the first and the most eye-catching point is that no country is pulling firther ahead which requires a recent level and growth performance over the EU average. All countries that have a market share in the global markets higher than the average loosing momentum with a growth performance lower than average annual growth rate. These countries are the most developed members such as United Kingdom, France, Germany etc. On the other hand, CzechRepublic andSlovakia shows very high performance with a fast catching up process. Turkey, Poland and Hungary are the other main catching-up countries. Surprisingly, member such as Finland, Austria, Sweden could not succeed to increase their market shares since 2000 which are close to the EU average. Although, Austria and Denmark shows a high progress in terms of GERD and BERD, the market shares did not reflect such R&D expenditures which again takes attention to the transformation process of R&D inputs to outcomes.

4.2.4. Patents

The number of patent applications is another reflection of knowledge in the real economy since it is an indicator for the inventions that have the potential to be used commercially. While analyzing the patenting performance, two main shortcomings have to be kept in mind: All of the inventions are not patented and not all of the patents have the same importance for using commercially as an innovative technology.

In order to measure patent applications there are two alternative institutions: The Patent Cooperation Treaty (PCT) and Triadic patent families.PCT is an international treaty signed by 133 Paris convention countries. Instead of filling various national applications, PCT makes it possible to fill an international application having the same effect. The second alternative is the Triadic patent families produced mainly by The European Patent Office, the US Patent and Trademark Office and the Japanese Patent Office.

Table 4.6 shows that in the period of 2000-2005, overall patent applications with EU-27 investors increased by 13% compared of 9,6% for US. The applications from Asian countries showed a significant increase in the same period such as Japan

(100 %), South Korea (161 %), China (137 %). Although these growth rates are relatively small in absolute numbers, except Japan, the total share of the EU and the US has declined from 75,7 % to 64 % whereas Japan's share has increased from 10,5 % to 16,3 % and South Korea and China have increased their shares by at least 80 %. There is one important comment in these numbers stating that the Asian countries began to use PCT more recently so this huge increase is the sum of both increase in patenting activity and more usage of the PCT

Table 4.6: Patent Applications in EU and its Main Rivals in 2000 and 2005 (World Market Share in %)

	Patent Applications (% share in the world)							
	Total		**Biotechnology**		**ICT**		**Nanotechnology**	
	2000	**2005**	**2000**	**2005**	**2000**	**2005**	**2000**	**2005**
US	39,7	33,2	49,2	39,7	44,8	34,6	51	42,9
EU-27	36	30,9	24	24,9	31	24,8	24,8	26,6
Japan	10,5	16,3	81,3	82	11,8	18,3	14,1	14,1
South Korea	1,9	3,8	1,2	2,3	2,2	4,6	0,5	3,6
China	1,5	2,8	9,5	1,3	0,6	4,2	0,6	1,5

Source: European Commission, (2008d), p.68.

Beside the overall number, the technology intensity of the patent applications should be observed to see the focus of the countries. The fields of Biotechnology, ICT and nanotechnology are stated as "enabling Technologies" that facilitates new inventions in other industries. Considering these three fields together, data shows that US has a concentration unlike EU. In biotechnology, the total number of applications decreased in the period of 2000-2005. Japan increased the number of applications by more than 50% while there was decline in US, EU and China. The ICT applications cover more than 35% of total patent applications. Concerning ICT, the number of applications in EU and US did not change while they increased tenfold in China and doubled in Japan and South Korea. Unlike ICT, the nanotechnology patents are dominated by US with a share of 42,9% while the share of EU shows a small increase from 25% to 26,6%. Putting these numbers together, Asian countries, especially China, can be said to focus on ICT although Japan tries a relatively broader perspective.[140]

[140]European Commission, (2008b), pp.68-70; OECD, (2007), p.55.

EU-27 is relatively more specialized on medium technologies such as 'general machinery', 'machine tools', 'metal products' and 'transport' than high technology fields like 'pharmaceuticals', 'computers, office machinery', 'telecommunications'. Unlike EU, US heavily focus on 'medical equipment' followed by 'pharmaceuticals' while Japan gives more importance to 'electronics' and 'optics'In the period of 1999-2005, EU slightly increased its specializations in sectors such as 'machine tools', 'measurement and control', 'energy machinery', 'transport' and 'pharmaceuticals'. In the same period, US focused more on ‘medical equipment' and 'pharmaceuticals' as mentioned above. US hasleft ‘electronics’ and ‘optics’ resulting witha sharp decrease of specialization. On the other hand, Japan focused more on 'optics' 'basic chemicals' and 'polymers' while losing space in ICT technology.

The second aspect of the analysis on patent applications examines the trends in member states and Turkey. Since the performance of member states are observed, the applications to European Patent Office (EPO) has considered in order to avoid the fact that usage of international patents such as PCT and Triadic patent familiesdiffers across countries (for example, many Asian countries has recently began to use PCT) which underestimates the level in these countries.Table 4.7 shows that the only country falling further back is the United Kingdom while all new accession countries and Turkey are catching-up with a very high annual growth rate relatively to the EU average of 2,69% per year. Just like R&D expenditures, Denmark and Austria are the included in the highest performers. Netherlands and Sweden are also showing high performance despite their low progress in R&D expenditures. France and Finland are again loosing momentum despite their recent level like expenditures.

Beside the number of applications, the breakdown of the patents by economic activity also provides insights about the developing sectors of the countries. In general, chemicals and electrical and optic equipments have the highest proportion of applications. Beside these areas, countries such as Malta, Turkey, Italy and Austria have more applications for machinery while Germany, Luxembourg, Romania and France focus more on transport equipments.[141]

[141]Eurostat, (2010a), p.188.

Table 4.7: AAGR of Patent Applications in MemberStates and Turkey between 1998-2007 and Patent Applications to EPO in 2007 (per million inhabitants)

		2007	AAGR (1998-2007)
	EU-27	116,54	2,69
Pulling Further Ahead (High Level - High Progress)	Sweden	298,36	2,87
	Luxembourg	230,16	3,43
	Netherlands	223,49	3,7
	Austria	216,97	8,73
	Denmark	194,05	3,39
Losing Momentum (High Level - Low Progress)	Germany	290,7	2,39
	Belgium	139,03	2,47
	France	132,37	1,7
	Finland	250,76	0,95
Catching Up (Low Level - High Progress)	Italy	86,37	4,97
	Ireland	66,83	3,87
	Slovenia	51,47	17,98
	Spain	32,62	11,56
	Malta	20,45	7,9
	Estonia	17,42	40,5
	Hungary	17,15	23,16
	Czech Republic	15,78	15,95
	Portugal	11,44	36,68
	Greece	9,79	7,87
	Latvia	8,4	37,25
	Slovakia	7,83	28,08
	Poland	3,82	47,03
	Bulgaria	3,78	27,07
	Turkey	3,16	62,04
	Lithuania	2,41	129,82
	Romania	0,98	36,23
Falling Further Behind (Low Level - Low Progress)	United Kingdom	89,16	0,04

Source: Eurostat Statistics Database.http://epp.eurostat.ec.europa.eu(21.11.2011)

CHAPTER 5: EMPIRICAL STUDY

5.1. SECTORAL COMPOSITION OF INTERNATIONAL TRADE IN TURKEY

Table 5.1 shows the classification of sectors according to SITC Rev 3. Section numbers 0, 1, 2 and 4 are agricultural products whereas sections of 5, 6, 7 and 8 are included in manufacturing sector. Section 0 includes live animals, meat, dairy products, cereals, vegetables etc.; Section 1 includes alcoholic and non-alcoholic beverages and manufactured and unmanufactures tobacco etc.; Section 2 is consists of hides and skins, cork and wood, textile fibers etc; Section 3 represents natural resources such as coal, petroleum and gas; Section 4 includes animal and vegetable oils and fats; Section 5 represents organic and inorganic chemicals, plastics, pharmaceutical products: Section 6 is consists of leather, paper, wood manufactures, iron and steel; Section 7 contains power generating machinery, electrical machinery, road vehicles, Office machines and telecommunications; Section 8 comprises footwear, furniture, articles of apparel and clothing, prefabricated buildings and finally Sections 9 covers commodities not classified elsewhere such as gold (non-monetary), coin (not being legal tender) etc.

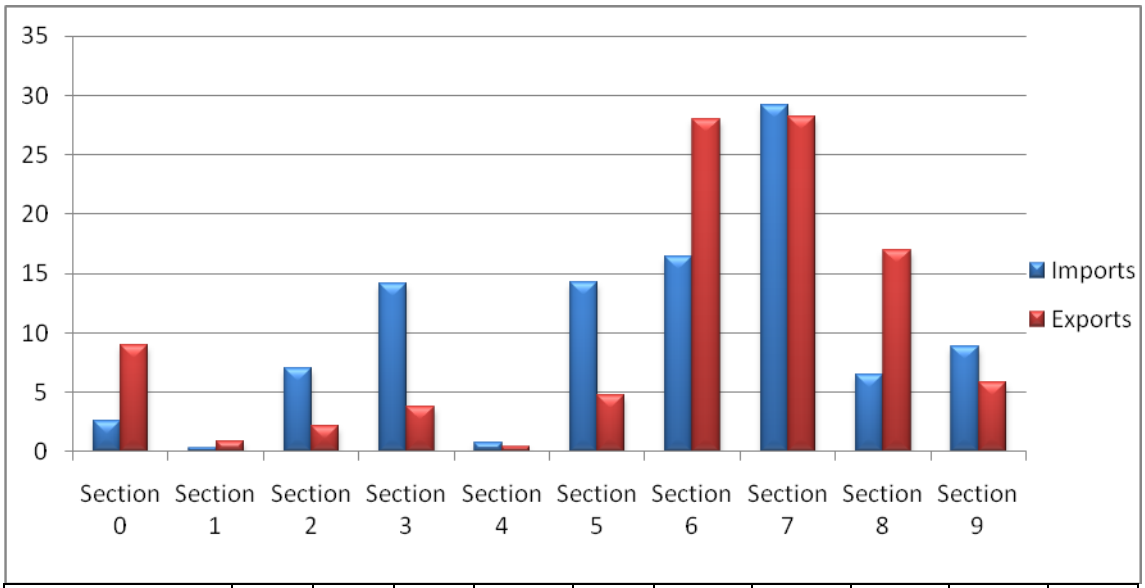
Table 5.1: Sectoral Classification Accroding to SITC Rev

Section Number	Section Definition
0	Food and Live Animals
1	Beverages and Tobacco
2	Crude Materials, Inedible, Except Fuels
3	Mineral Fuels, Lubricants and Related Materials
4	Animal and Vegetable Oils, Fats and Waxes
5	Chemicals and Related Products, N.E.S.
6	Manufactured Goods Classified Chiefly by Material
7	Machinery and Transport Equipment
8	Miscellaneous Manufactured Articles
9	Commodities and Transactions not Classified Elsewhere

Source: UN Comtrade Database.http://comtrade.un.org/db/mr/rfCommoditiesList.aspx?px=S3&cc=TOTAL(21.11.2011)

Figure 5.1 shows the composition of Turkish exports and imports in 2009 according to the SITC classification. According to the table, manufacturing sector (Sections 5,6, 7 and 8) represents %80 of total exports and % 76 of total imports. The most important export sections are machinery and transport equipment and manufactured goods classified chiefly by material. These two sections is equal to half of total exports. The highest proportion of imports is machinery and transport equipment while the rest is mostly shared by the manufactured goods classified by material, chemicals and related products and mineral fuels and lubricants. Since these sectors produce high value added products and the high technology products are generally included in these sectors, (mostly Sections 5 and 7)[142], more detailed analysis should be made on these sectors regarding the recent trade values and potential sectors to focus on. Regarding the distribution of exports, the high share of Section 7 and low share of Section 5 shows a mixed picture of high technology production in Turkey.

Figure 5.1: Sectoral Composition of Exports and Imports in Turkey in 2009 (%)



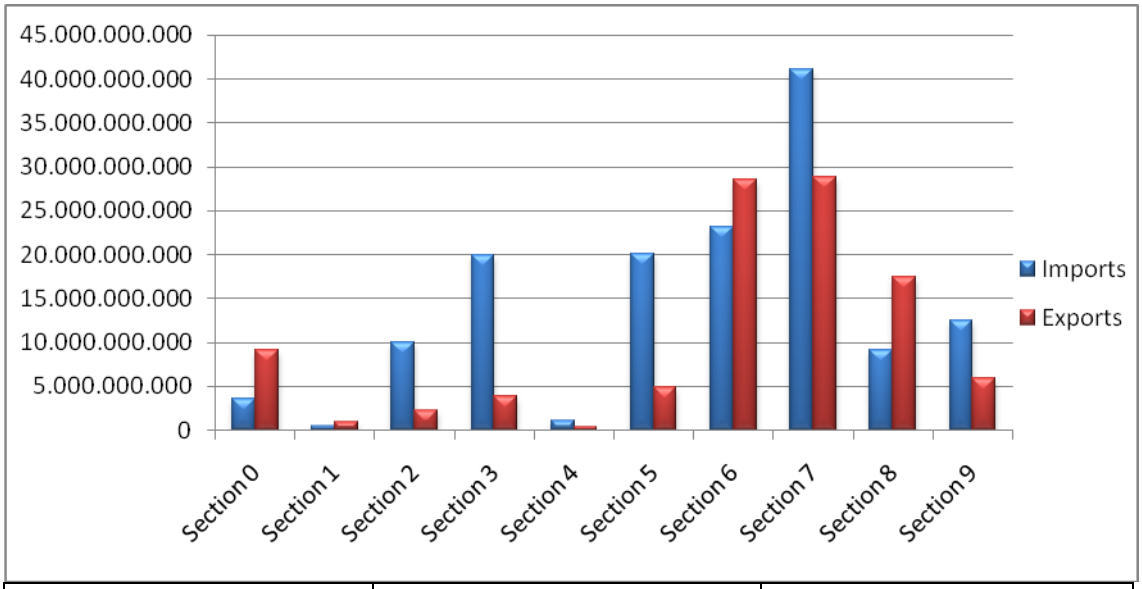
Section Number	0	1	2	3	4	5	6	7	8	9
Imports	2,55	0,34	7,05	14,14	0,80	14,25	16,45	29,14	6,46	8,82
Exports	8,94	0,91	2,18	3,82	0,42	4,74	28,00	28,20	17,01	5,79

Source: UN Comtrade Database.http://comtrade.un.org(21.11.2011)

[142] See the table at page 86.

Figure 5.2 shows the import and export values in 2009 according to SITC Rev 3. Total exports in 2009 is 102 billion dollar and imports costs 140 billion dollar. Food and live animals, beverages and tobacco, manufactures goods classified chiefly by material and miscellaneous manufactured articles are the sections with positive trade balance while in the rest of the sections Turkey experienced a trade deficit. Trade deficit in mineral fuels is mostly occured due to petrolleum import and since it is dependent on natural resources, the situation in this section can only be reversed by searching for alternative energy sources and replacing the petrolleum with sources like electricity etc. In the highlighted sections of 5, 6, 7 and 8, there is a significant trade deficit around 14 billion dolar.

Figure 5.2:Exports and Imports in Turkey in 2009 According to SITC Rev 3(US $)



Section Number	Imports	Exports
Section 0	3.589.125.042	9.126.402.203
Section 1	478.934.888	932.944.958
Section 2	9.932.675.908	2.223.331.330
Section 3	19.924.422.253	3.901.121.738
Section 4	1.122.360.314	427.218.763
Section 5	20.069.533.534	4.836.714.850
Section 6	23.170.857.152	28.600.792.785
Section 7	41.046.907.893	28.803.454.827
Section 8	9.106.577.572	17.377.685.087
Section 9	12.427.618.878	5.908.859.150

Source: UN Comtrade Database.http://comtrade.un.org(21.11.2011)

The more important issue than the amount of deficit is the sectors that the deficit comes from. According to the table, the highest trade deficits occurs in Sections 5 and 7 which includes most of the high technology products. Although the machinery and transport equipments section has the highest share in exports, this section has the highest trade deficit. Also, although there is a trade surplus in manufactured goods classified by material and miscellaneous manufactured articles, these sections include products such as leather, wood, textile, paper manufactures and iron and steel, furniture, footwear etc. which have relatively low technology and value added. Although iron and steel sector is a significant sector in many aspects, the production in Turkey is based on long steel rather than flat steel which includes higher level of technology..

Table5.2: Sectoral Composition of Exports and Imports in Turkey in 2000 (US $) and(%)

Section	Exports ($)	Imports ($)	Exports (%)	Imports (%)
0	2.869.327.330	1.155.258.861	10,4	2,1
1	528.581.967	364.503.040	1,9	0,7
2	670.574.095	3.283.343.555	2,4	6,1
3	293.763.535	7.514.984.144	1,1	13,9
4	99.868.279	374.652.964	0,4	0,7
5	1.063.213.971	7.351.629.540	3,9	13,6
6	8.145.654.176	8.380.150.848	29,6	15,5
7	5.667.009.822	20.347.780.216	20,6	37,6
8	7.828.685.601	3.309.197.217	28,5	6,1
9	318.680.321	2.068.294.899	1,2	3,8

Source: UN Comtrade Database.http://comtrade.un.org(21.11.2011)

Another aspect of the analysis on composition of international trade in Turkey is the trend since 2000. Table 5.2 shows the sectoral composition of exports and imports in 2000 in US dolar and % as the sectoral composition. When Figure 5.1 and Table 5.2 are compared regarding sectoral composition, it is seen that the share of Section 7: Machinery and Transport Equipment in overall exports increases from 20% in 2000 to 28% in 2009. In the same period, the share of Section 7 decreases from 37% in 2000 to 29% in 2009. These statistics together shows that there is a significant positive change in trade of Section 7 which is an important sector as described above.Another clear shift in trade composition is the decreasing share of Section 8 which includes mostly

furnitures and clothing. The share of Section 8 in 2000 was 28% while this ratio decreased to 17% in 2009.

Regarding the trade volume, the comparison of Figure 5.2 and Table 5.2 shows that first, the only sector in which the position of trade balance change is Section 6 that includes that paper, wood and iron and steel. Although, there was a small trade deficit in this section in 2000, the trade balance turned to positive in 2009. In the other sections, the sign of the trade balance did not change, however, there are some changes in the volume of trade balances. In all sections with negative trade balance, the ratio of trade deficit to the exports in these sections showed a clear decrease. For example, the trade deficit in Section 7 was equal to 260% of the exports in this section in 2000, while in 2009 this ratio decreased to 42% which is still a definitely high level. Similarly, the ratio of trade deficit in Section 5 showed a fall from 600% of the exports to 300% in 2009.

Putting these together, it can be said that the trend in the composition of international trade structure of Turkey shows positive developments but the recent composition is stil far from the desired level. Significant reforms should be made in production and international trade that is going to change the trade balance both in total amount and, more importantly, in the sectoral aspects. The manufacturing sector, sections 5 and 7 in particular, should be made more competitive and more attention should be given to the sectors under these sections.

5.2. RECENT STRATEGIES ON INTERNATIONAL TRADE IN TURKEY

The trade statistics above shows the need for a structural change in production and international trade. For example, the section 5, machinery and transport equipments, with the highest export share has the highest amount of trade deficit.Such a trade structure makes it impossible to close the current account deficit because exports can not increase without accelerating imports. This fact requires to deepen the analysis in terms of type of products that are traded. Table 5.3 shows the composition of imports and exports in 2010 according to the type of products namely investment, intermediate

and consumption goods.It is seen that intermediate goods cover 70% of the imports following by investment goods and consumption goods. Also, beside the amount, the trade balance of intermediate goods has been negative during the period with a growth trend however the balance for the sum of investment and consumption goods and services has been positive in the same period.[143]

Table 5.3: Exports and Imports in Turkey in 2010 According to Type of Products

	Imports (million $)	Share (%)	Exports (million $)	Share (%)
Investment Goods	28.820	15,5	11.774	10,3
Intermediate Goods	131.397	70,8	56.362	49,5
Consumption Goods	24.734	13,3	45.352	39,8
Other	546	0,3	411	0,4
Total	185.497	100	113.899	100

Source: Undersecretariat of the Prime Ministry for Foreign Trade, (2011a), **Input Supply Strategy,** 24.04.2011 http://www.aso.org.tr/b2b/haber/haberoku.php?haber_no=2793(21.11.2011)

When the sectors are observed more detailed in Table 5.4,it is seen that metals and mining products are covers the highest proportion of the intermediate goods imports. Since these are basic raw materials, in order to obtain these materials, mining activities of Turkish firms in Turkey and other countries has to be supported. China, for example, significantly increased its mining investments around the world in the last years. Beside the raw materials, there is a high level of imports in automotive and chemicals. As it is mentioned above, these sectors are included in sections 5 and 7 which include most of the high technology products. Considering the fact that automotive is a very important sector in Turkey with an increasing global market share from 0,5% in 1999 to 3,5% in 2008, the imports in this sector in particular draws attention.[144]Another aspect of the intermediate goods especially in automotive sector is the increasing number of Free Trade Agreements (FTA) of Turkey established both due to the responsibilities in Customs Union and changing global business environment requiring further economic integration both regional and global. In general, according to the “rules of origin” in FTAs, automobile can not be originated to a country without

[143] Undersecretariat of the Prime Ministry for Foreign Trade, (2011a), slide 2.
[144] Undersecretariat of the Prime Ministry for Foreign Trade, (2011a), slides 8-24.

producing its engine or a television can not be originated without producing its tube etc. because these parts are the most expensive inputs of final products. Without producing these parts, the concessions taken in the FTAs can not be applied and significant sectors in Turkey will become more fragile. Considering the increasing international trade volume around globe and Turkey in particular, issues like the one mentioned above is going to be more important in the future.

Table 5.4: Sectoral Classification of Intermediate Goods Imports in Turkey in 2010 (%)

Iron - metals other than iron and mining	28,5
Automotive - Machinery	19,2
Chemicals	21,6
Agriculture	7,5
Textiles	9,9
Other	13,3

Source: Undersecretariat of the Prime Ministry for Foreign Trade, (2011a), slide 8.

Due to need for structural reforms in production and international trade structure and economic growth plans based on export performance, "Exports Oriented Production Strategy Assesment Board" was established and published in Official Gazette of Republic of Turkey dated 12.05.2010 and No. 27579. [145] The Board is composed of executives from related ministries and institutions such as TUBITAK, TOBB etc. Under the supervision of the Board, Undersecretariat of the Prime Ministry for Foreign Trade (DTM) has established the "Input Supply Strategy (GITES)" by considering the need for structural change in international trade. GITES designs the mechanisms for the supply of intermediate goods which includes both the raw materials and the high technology products such as chemicals and other complex parts. Regarding the raw materials, the plan can be summarized as supply of raw materials within Turkey by developing infrastructure and technical processes in mining sector beside supporting concentration plants to produce complex materials.For the products which can not be obtained within Turkey,increasing investments abroad similar to the implementation of China is projected. Import of "Scrap" is one of the highlighted issues in the plan regarding raw materials. It is mentioned that imports of scrap in 2010 covers

[145] Official Gazette of Republic of Turkey, (2010), **Exports Oriented Production Strategy Assesment Board** , dated 12.05.2010, No:27579.

15% of the current account deficit and in order to increase domestic supply, communication with the local administrations is developed.[146]

As the second aspect of GITES which is more concerned with this context of this study, automotive and iron and steel industries are emphasized. It is mentioned that half of the intermediate good imports and the lowest rate of domestic good usage occurs in automotive sector. There is a definite import dependence from engines to electronics and software of the automobiles. Also, in the iron and steel industry, the need for progress in flat steel production which requires more technological production methods is stated. The main mechanism against these problems is mentioned as efforts to increase cooperation between automotive and electronic sectors. In parallel with this objective,meetings have been organized in DTM that gathers representatives from different sectors as a part of the cooperation efforts. For example, increasing contribution of defence industry, as a more developed sector especially in parts such as vehicle electronics, to automotive sector is one of such efforts. Also, building plants for producing complex materials used in these sectors are part of the Strategy as mentioned above.

Since the starting point of this study is the dependency of the exports to imports of high technology intermediate goods, the instruments of GITES is, indeed, one of the policy implications of this thesis but as it is mentioned in the chapter for Lisbon Strategy, both the implementation of action plans and the recognition of the strategies are vital for the succees beside the objectives. For example, in the meeting for the introduction of GITES, the plan was defined to be based mostly on the supply raw materials which can not be obtained within Turkey. Also, in many media channels GITES was announced as a project on imports of scraps. If GITES turns into such a plan, its impact on the international trade structure will be very limited.

5.3. LITERATURE REVIEW

Since there is a strong link between economic growth and level of export in theory and practice, the historical and theoretical development of models explaining

[146]Undersecretariat of the Prime Ministry for Foreign Trade, (2011b), **Input Supply Strategy Meeting**, 23.03.2011.http://www.dtm.gov.tr/dtmweb/bakanHaberDetay.cfm?haberNo=1410(21.11.2011)

contribution of technology competitive advantage and economic growth will be mentioned together. Robert Solow improved the model of Harrod and Domar, who first stated technology as a factor of growth, in 1956. After him, mainly Michael Vivian Posner and Paul Krugman developed the "North-South Trade Theories" and in 1980s Robert Lucas and Paul Romer established the "Endogenous Growth Models" with more micro economic point of view.

The acceptance of the relation between technology and growth by the neo-classical approach happened by the models of Robert Solow and Trevor Swan. Indeed, Solow mainly used Harrod-Domar model of economic growth and changed one of the basic assumptions. In his article, "A Contribution to the Theory of Economic Growth", Robert Solow summarized his study as follows: "*The bulk of this paper is devoted to a model of long-run growth which accepts all the Harrod-Domar assumptions except that of fixed proportions. Instead I suppose that the single composite commodity is produced by labor and capital under the standard neoclassical conditions"* Harrod and Domar model claimed a fixed ratio between capital and output, so there is no possibility for substituting labor for capital in production. Robert Solow, instead, abandoned that assumption and stated a production function with two production factors as Labor (L) and Capital (C) which can easily be substituted according to the choices of the producers. According to the model of Robert Solow, when unexpected shocks in the economy occurs, new equilibrium can be managed by the changing capital-output ratio in contrary to the assumption of Harrod and Domar.[147]

Robert Solow instead wrote the production function follows:

$$Q = F(K,L;t)$$

In the model, Q represents output, K and L represents capital and labor. The variable t allows technical change which is defined as *any kind of shift in the production function.*[148] Robert Solow assumed that technical change is neutral that means it affects capital and labor in same level. As an empirical study, he used data from US in the

[147] Solow, Robert, (1956), "A Contribution to the Theory of Economic Growth", **Quarterly Journal of Economics**, Vol. 70, No. 1, pp 65-68.
[148]Solow, Robert (1957), "Technical Change and the Aggregate Production Function", **The Review of Economics and Statistics,** Vol. 39, No. 3, p.312.

period of 1909-1949 with the time series output per unit of labor, capital per unit of labor, and the share of capital. According to the model, he stated that gross output per man hour doubled in the time period while 87% of the increase happens due to technical change and the rest due to increased use of capital.[149]

In 1961, Michael Vivian Posner summarized nature of international trade in manufactured goods in his article, "International Trade and Technical Change", as follows: *"... trade may be caused by technical changes and developments that influence some industries and not others; because particular technical changes originate in one country, 'comparative cost differences' may induce trade in particular goods during the lapse of time taken for the rest of the world to imitate one country's innovation"*[150] In his paper, M. V. Posner established a two country model and assumed that even the two countries have identical factor endowment, all factors of production exist in equal proportion, country A is unable to produce the product of country B and defined a term "learning period" as the necessary time for adaptation of A to B's superior technique. Assuming identical factor endowment leads to the fact that the only difference between the countries occurs due to technical differences of the products, so when the learning period is completed, country A and B becomes identical economies. M. V. Posner asks the questions of trade depends on whether dynamic or statis economies of scale and the comparative advantage is whether stable or unstable. In the model, the reason for diminishing costs of production is due to the fact that particular firm can now draw on its experience of yesterday's production which is defined as dynamic economies of scale. Consequently, the model states that the difference between the two countries is based on the technological gap and the learning period for imitating the innovations which leads to the fact that the comparative advantage can continue according to these two variables. [151]

Paul Krugman is another supporter of North-South Trade Theories. Just like the formulation of M. V. Posner, he defines two countries with different level technologies as *innovating North and noninovating South.* Paul Krugman summarizes

[149]Solow, Robert (1957), pp.314-320.
[150]Posner, M. V. (1961), "International Trade and Technical Change", **Oxford Economic Papers**, Vol. 13, No. 3 p.323.
[151]Posner, M. V., (1961), pp.325-340.

the nature of trade, resulting from technological gap, as follows: "*This technological lag gives rise to trade, with North exporting new prod- ucts and importing old products. Higher Northern per capita in- come depends on the quasi rents from the Northern monopoly of new products, so that North must continually innovate not only to maintain its relative position but even to maintain its real income in absolute terms."*[152]in his article"A Model of Innovation, Technology Transfer, and the World Distribution of Income". Paul Krugman, again as it is mentioned by M. V. Posner, states that the continuty of this situation and incomes of Northern residents depends on the rents from their monopoly of newly developed products and in order to avoid the erosion of this monopoly, the innovation process in North has to be permanent. Paul Krugman explains this situation by refering to Alice in Wonderland as *"Like Alice and the Red Queen, the developed region must keep running to stay in the same place."*[153]

Paul Romer, in his model which he defines *one-sector neoclassical model with technological change, augmented to give an endogenous explanation of the source of the technological change*, explains the involvement of R&D sector in economy in detail by showing the interactions of the sectors.[154] In the article, "Endogenous Technological Change" Paul Romer, from a micro economic point of view, established his model on three pillars. First assumption claims that technological change, which is defined as *improvement in the instructions for mixing together raw materials,* is the basic reason for economic growth since it provides continuous capital accumulation. Second assumption is that since the technological change is controlled by the profit maximazing economic agents in the market conditions, it is an endogenous variable rather than an exogenous one as defined by Robert Solow. Although not everyone who is included in R&D activities is motivated by private sector, market incentives play a key role in transforming *knowledge into goods with practical value*. The last assumption defines the main characteristics of technology as being a fixed cost since once the production method etc. is developed, there will be no additional cost for using again. last assumption creates a link between technology, market size and rate of growth.

[152]Krugman, Paul, (1979), p.253.
[153] Krugman, Paul, (1979), pp. 259-262.
[154] Romer, Paul, (1990), "Endogenous Technological Change", **The Journal of Political Economy**, Vol. 98, No. 5, Part 2, p.99.

According to the model, fixed costs can be acceptable in larger markets and larger markets induce more research and faster growth. Based on these three assumptions, Paul Romer claims a monopolistic competition due to the fact that price-taking behaviour can no longer be valid since the cost of creating a new good can be added to the products. [155]

Paul Romer explains the working mechanism of economy with R&D sector as follows: there are three sectors in the economy: R&D sector, intermediary sector and the sector of final goods. The main inputs are physical capital, human capital, labor and technology. The physical capital is the sum of consumption and capital goods while the human capital includes the vocational training and formal education. The human capital exists both in the equation of R&D sector and final goods sector. According to the model, the R&D sector creates "patents" to feed the intermediary sector by using the knowledge stock and human capital. In the final phase, the final production occurs with intermediary goods, labor and human capital. Also there is a cycle of the creation of patent and knowledge stock.[156]

Based on this background, researchers that suggest a relation between R&D expenditures and export performance applies firm level and country level studies. The country level studies generally comprise panel data with multi country and year. The study of Pontus Braunerhjelm and Per Thulin cover 10 OECD countries in the period of 1981-1999. In the model, the endogenous variable is defined as country's exports of high technology products divided by total exports. In the study, the key explanatory variables are level of expenditure on R&D and market size. In addition to these variables, a control variable is included representing the effect of foreign direct investment, technology balance of payments, real GDP per capita, public spending on education. The study suggests thatone percentage increase in R&D-expenditures leads to three-percentage point increase in high-technology exports while the market size does not show a statistically significant relation.[157]

[155]Romer, Paul, (1990), pp.72-73.
[156]Romer, Paul, (1990), pp.79-88.
[157] Braunerhjelm, Pontus and Thulin, Per, (2008), "Can Countries Create Comparative

Another country level study is done by Belay Seyoum in 2005 on the determinants of high technology exports. The study investigates the impact of technological infrastructure (contains total expenditure on R&D per capita as well as scientists and engineers engaged in R&D), home demand conditions and inward foreign direct investment. The endogenous variable is chosen as high technology exports expressed in terms of millions of current dollars.The model confirms that all three variables affect export performance while FDI carries the heaviest weight.[158]

In the study of Imaculada Martinez and Celestino Suarez, the effects of technological factors and productivity differences on export performance of a country is investigated with data of 12 sector in six EU countries in the period of 1981-1990. Net exports in each industry are used as endogenous variable while sectoral R&D expenditures and value added per worker are chosen as explanatory variables. The results show that R&D expenditures have a significant effect on net exports in sectors such as chemical, office and computing machinery and transport equipment.[159]

Jan Fagerberg established a table including results from a number of studies, including his studiesi, investigating the impact of technology and other factors on trade performance. The explanatory variables are listed as R&D expenditures, number patents, prices, foreign direct investment and market size. Although studies show heterogeneity among countries about the impact of technology and other variables on trade performance, R&D expenditures and patents are the most emphasized variables in many sectors. On the other hand, for the impact of market size and FDI are more mixed.[160]

There is a quite large and developing literature on the contribution of R&D on expprt performance and economic growth. The working mechanism of R&D sector has become clearer from Robert Solow to Paul Romer. Although, the classification "North

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Advantages?R&D Expenditures, High-tech Exports and Country Size in 19 OECD Countries, 1981–1999", **International Economic Journal**, Vol. 22, No. 1, pp. 99-101.

[158]Seyoum, Belay, (2005), "Determinants of Levels of High Technology Exports an Empirical Investigation", **Advances in Competitiveness Research**, Vol. 13, No. 1, pp.73-75.

[159] Martinez, Imaculada and Suarez, Celestino, (2000), "The determinants of Trade Performance: Influence of R&D on Export Flows", **Applied Economics**, Vol. 32, pp.1941-1943.

[160] Fagerberg, Jan, (1996), "Technology and Competitiveness", **Oxford Review of Economic Policy**, Vol. 12, No. 3, pp. 45-48.

and South" does not represent the recent global economic environment, the main statement of North-South Theories as need for continuous innovation for maintaining high income is true with no doubt considering the economic development of Asian countries based on high technology production and the fact that R&D expenditures on China is almost same with the EU. The developing literature on this subject confirms the argument of this study that in the recent economic conjuncture, investing in innovation and producing high value added and high tech products provides economic growth based on increasing international competitiveness.

5.4. MODEL AND METHOD

E-views 5.1 has been used in computing the regression analyses. Before testing the effect of R&D related variables on high tech export performance in Turkey with the econometric method of Ordinary Least Squares (OLS), the descriptive statistics of the Turkish data have been depicted in order to show the relations between variables. The effects of R&D relatedactivities on export performance of Turkey are analyzed for the period of 1990-2009 by applying OLS which is frequently used in regression analysis because *it is intuitively appealing and mathematically much simpler than alternative methods.*[161]

Table 5.5: Correlation Between Variables

	Share of Exports	GERD	GOVERD	BERD	HERD
Share of Exports	1,00	0,87	0,71	0,88	0,76
GERD	0,87	1,00	0,91	0,96	0,91
GOVERD	0,71	0,91	1,00	0,91	0,74
BERD	0,88	0,96	0,91	1,00	0,76
HERD	0,76	0,91	0,74	0,76	1,00

Table 5.5 is established in order to show the relations between variables. The table shows that, in general, there are high and positive correlations between variables. GOVERD and BERD have a very high level of correlation around 90% while HERD's correlation with other sectoral R&D expenditures are relatively lower around 75% which is still a high ratio. Also, overall R&D expenditures (GERD) has high level of

[161] Gujarati, D. N., (2004), **Basic Econometrics**, Fourth Edition, McGraw−Hill Companies, p.58.

correlation with all sectoral expenditures which is already expected since GERD is the sum of sectoral R&D expenditures. Due to the high correlations between variables, they should be utilized separately in regressions.[162] In order to overcome the disturbing effects of high correlation on the models, regression models are established with single explanatory variables. Another limitation of the regression model is the low number of observations. This weakens the realibilty of the diagnostic tests which designed for more observations. And also, just the correlation, it forces to remove the variables and establish models separately.

5.4.1. Hypothesis

The second question of this study asks whether the R&D expenditures has a positive impact on international competitiveness which is represented by high technology exports share of Turkey within the OECD countries. In order to find out this relation first hypothesis will be tested:

H_1: Turkey's overall R&D expenditures (GERD) has an influence on its high technology exports share.

While answering this question, the analysis will be deepen and a sectoral comparison will be applied in order to show the impact of government, private sector and higher education R&D expenditures and make policy implications. Although it changes according to the economic structure of the country's economy, in EU and most of the developed countries, the contribution of the private sector to R&D activities are increasing and in the Lisbon Strategy two thirds of the overall R&D expenditures in EU is projected to be handled by the private sector. Based on this literature, the second hypothesis will be tested to find out whether the impact of the private sector R&D expenditures on high technology exports share is highest or not.

H_2: Business R&D expenditures (BERD) has the highest influence on high technology exports share of Turkey.

[162]Taymaz, E. and Özçelik, E., (2004), "Does Innovativeness Matter for International Competitiveness in Developing Countries? The Case of Turkish Manufacturing Industries", **Research Policy**, No. 33, p.418.http://www.erc.metu.edu.tr/menu/series01/0107.pdf(21.11.2011)

The effects of R&D efforts on the share of high tech exports can be effective in the lagged periods rather than the same time period because the mechanism that includes the transformation of R&D expenditures into the goods sold in the market can be completed in longer periods.[163]In order to explore such a relation third hypothesis will be tested.

H_3: R&D expenditures has an influence on high technology exports share in lagged periods.

5.4.2. Models

In order to test the hypothesis above, the regression models below are established:

Share of Export $_t = a_1 + b_1 (GERD)_t + u_t$
Share of Export $_t = a_2 + b_2 (GOVERD)_t + u_t$
Share of Export $_t = a_3 + b_3 (BERD)_t + u_t$
Share of Export $_t = a_4 + b_4 (HERD)_t + u_t$
The dependent and independent variables in the model are defined as follows:

Share of Export: High technology exports share of Turkey in OECD(%)
GERD: Gross domestic expenditure on R&D as a % of GDP
GOVERD: Government expenditure on R&D as a % of GDP
BERD: Business enterprise expenditure on R&D as a % of GDP
HERD: Higher education R&D Expenditures as a % of GDP

5.4.3. Diagnostic Tests

In order to test the empirical validity of the series and models, diagnostic tests for normality, autocorrelation, heteroscedasticity and unit root (stationarity) are applied.The empirical results of the econometric models can be valid if the variable series are stationary (its mean and variance do not vary systematically over time).

[163] Gurmu, Shiferaw, (2007), "Patents, R&D and Lag Effects: Evidence from Flexible Methods for Count Panel Data on Manufacturing Firms", **Andrew Young School of Policy Studies Research Paper Series**, pp.21-22.http://aysps.gsu.edu/publications/2007/downloads/07-26%20GurmuPerez-PatentsR&DandLagEffects.pdf(21.11.2011)

Models with non-stationary series lead to spurious regression problem. In order to overcome spurious regression, Engle-Granger Two Step Procedure is applied.

The tests show that both the dependent variable (high technology exports share) and the explanatory variables (GERD, GOVERD, BERD, HERD) are integrated of degree 1 -Yt~I(1) ve Xt~I(1) - which these seriescan become stationary when their first difference is taken. Engle-Granger Approach states that when both explanatory and dependent variables are I(1) and if the residual of the model is $\hat{u}_t$~I(0),which means it is stationary, the series are cointegrated and the empirical findings of the model are realible. Engle-Granger Two Step Procedure is applied to the series in the models to test the existence of the cointegration between series. First, the regression models are established and run. Secondly, the residual series are build to test their stationarity.While testing unit root, MacKinnon critical values are used as criteria rather than normal values. Unit root tests are applied to the residual series of each model and it is seen that all residual series are $\hat{u}_t$~I(0).Considering these two facts, it is stated that the series are cointegrated and the results of the regression models are realible.

Autocorrelation, which means the error terms are correlated over time, is tested by "Breusch-Godfrey Serial Correlation LM Test". It is seen that the regression model showing the relation between high technology exports share and GOVERD has autocorrelation problem. In order to overcome the problem of autocorrelation, the model is estimated by using Newey–West estimator.Heteroscedasticity, which means the error terms do not have constant variance, is tested by "White Heteroskedasticity Test". The models do not show the problem of heteroscedasticity.

5.5. VARIABLES

The data of dependent and independent are gathered from OECD Main Science and Technology Indicators (MSTI)in order to avoid measurement differences. This database is published twice a year and includes final or provisional results and estimates established by government authorities. The data covers the time period between 1990 and 2009. Data for dependent and independent variables can be found in Appendix D. In order to classify the technology intensity of the exports, Standard International Trade

Classification Revision 3 (SITC Rev.3) was used. Table 5.6 shows the high technology products according to SITC.[164]

Table 5.6: High Technology Products According to SITC Rev 3

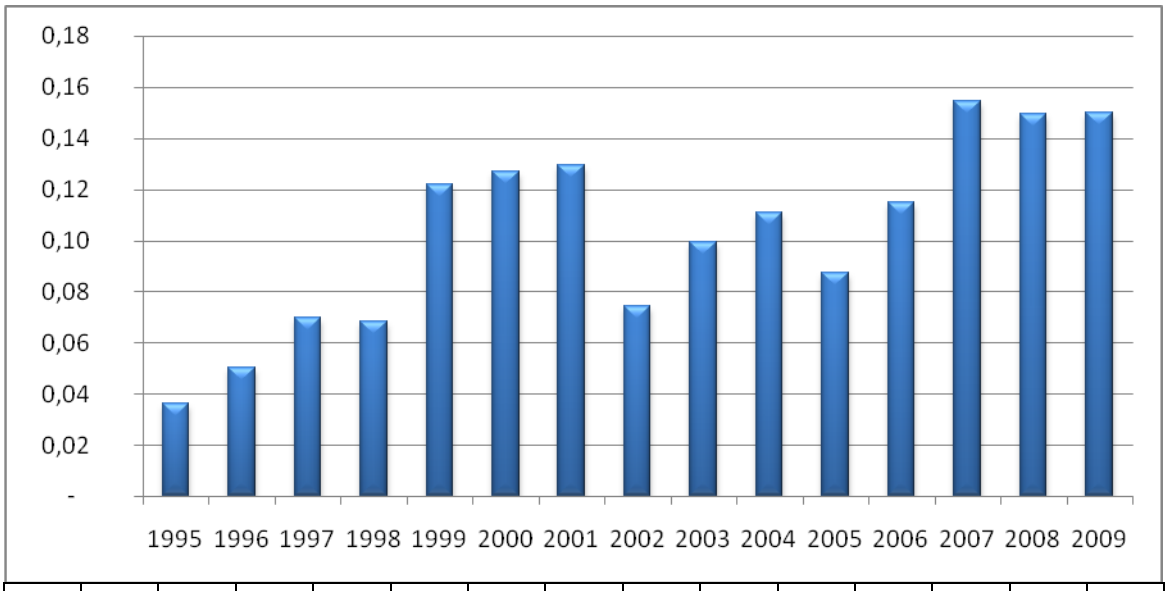
Aerospace:	7921 + 7922 + 7923 + 7924 + 7925 + 79293 + (714- 71489 – 71499) + 87411
Computers-office machines:	75113 + 75131 + 75132 + (752 – 7529) + 75997
Electronics-telecommunications:	76381 + 76383 + (764 – 76493 – 76499) + 7722 + 77261 + 77318 + 77625 + 7768 + 89879
Pharmacy:	5413 + 5415 + 5416 + 5421 + 5422
Scientific instruments:	774 + 8711 + 8713 + 8714 + 8719 + (874 – 87411 – 8742) + 88111 + 88121 + 88411 + 88419 + 89961 + 89963 + 89967
Electrical machinery:	77862 + 77863 + 77864 + 77865 + 7787 + 77844
Chemistry:	52222 + 52223 + 52229 + 525 + 57433 + 591
Non-electrical machinery:	71489 + 71499 + 71871 + 71877 + 72847 + 7311 + 73131 + 73135 + 73144 + 73151 + 73161 + 73312 + 73314 + 73316 + 73733 + 73735
Armament:	891

Source:OECD, (2005), **Handbook on Economic Globalization Indicators.**http://www.realinstitutoelcano.org/materiales/docs/OCDE_handbook.pdf

Figure 5.3 shows that the high technology exports had a continuous rising trend since 2000. High technology exports of Turkey are given as a percentage of OECD high technology exports. In Chapter 2, the mostly used competitiveness indicators are listed and market share in high technology exports are mentioned as one of the recent indicators applied due to the increasing focus on R&D and innovation in competitiveness concept. Taking into consideration the increasing focus on technology as a factor of competitiveness and the fact that high technology sectors are crucial in the competitiveness of the economy because they are more suitable for *gaining larger markets shares, creating new markets for products and using resources more efficiently; leading to high-value added production and bringing higher returns to the workers the employ, creating spill-over effect to the overall economy*[165], market share in high technology exports is chosen as an indicator of international competitiveness rather than all exports.

[164] Detailed list of high technology products can be found at, http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an4.pdf(21.11.2011)
[165]Eurostat, (2010a), p.219.

Figure 5.3: High Technology Exports Market Share of Turkey in OECD between 1995-2009 According to SITC Rev. 3



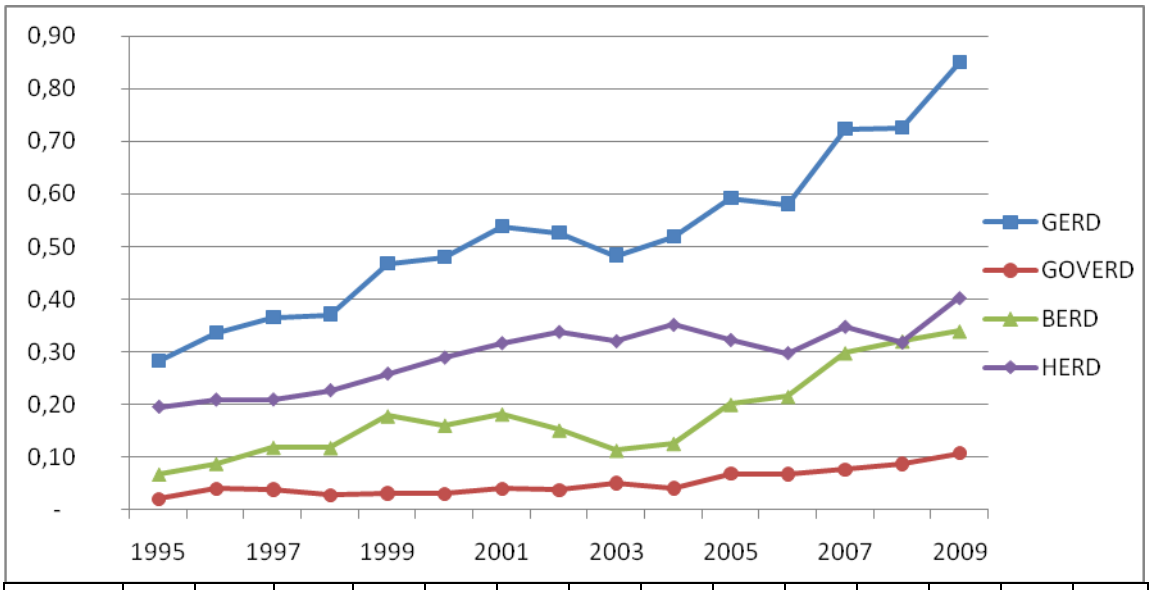
1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0,04	0,05	0,07	0,07	0,12	0,13	0,13	0,07	0,10	0,11	0,09	0,12	0,15	0,15	0,15

Source: Worldbank Database

The independent variables are chosen from the R&D targets which are mentioned in the Lisbon Strategy. The gross domestic expenditure on R&D (GERD) and business expenditure on R&D (BERD) stated as numeric targets as 3% and 2% of GDP (2/3 of total GERD expenditure is targeted to be covered by private sector)[166] while other variables (GOVERD, HERD) are included in order to apply a sectoral comparison between government, private sector and higher education R&D expenditures.

[166] European Council, (2002), p.20.

Figure 5.4: Sectoral Classification of R&D Expenditures in Turkey between 1996-2009 (% of GDP)



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
GERD	0,34	0,37	0,37	0,47	0,48	0,54	0,53	0,48	0,52	0,59	0,58	0,72	0,73	0,85
GOVERD	0,04	0,04	0,03	0,03	0,03	0,04	0,04	0,05	0,04	0,07	0,07	0,08	0,09	0,11
BERD	0,09	0,12	0,12	0,18	0,16	0,18	0,15	0,11	0,13	0,20	0,21	0,30	0,32	0,34
HERD	0,21	0,21	0,23	0,26	0,29	0,32	0,34	0,32	0,35	0,32	0,30	0,35	0,32	0,40

Source: OECDStatistics Database.http://stats.oecd.org(21.11.2011)

Figure 5.4 shows that overall R&D expenditures (GERD) has an increasing trend since 1990s which has further accelerated after 2003. When the sectoral separation is applied, it is seen that the increase in overall R&D expenditures is mainly due to increase private sector (BERD). Although, HERD is the most used type of R&D expenditure in 1990s, the gap between HERD and BERD has closed in the beginning of 2000 parallel to the trend in the world which encourages higher contribution of private sector to R&D activities.

5.6. EMPIRICAL FINDINGS

Table 5.8shows the impact of overall R&D expenditures on export performance.Sincethetail probability value is 0.0000 and prob(F-statistic) is 0.000001, both the variable and the model are statistically significant. R^2 is 75% which shows a moderate explanatory power for the model. The coefficient 0.23 shows that 1 unit

(percent) increase in overall R&D expenditures results in a 0,23 unit (percent) increase in high technology export share of Turkey in OECD high technology exports. The model shows that changes in GERD affects high technology exports share by approximately 20% which can be stated as a serious relation considering all factors affecting exports. The model results accepts H_1which claims that GERD has an influence on high technology exports share of Turkey.

Table 5.7: Estimates of GERD's Effects on High Tech Exports Share of Turkey (1990-2009)

Dependent Variable: HIGH TECH EXPORTS SHARE
Method: Least Squares
Sample (adjusted): 1990 2009

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GERD	0.233476	0.031357	7.445640	0.0000
C	-0.024085	0.015618	-1.542095	0.1404

R-squared	0.754894	Mean dependent var	0.086031
Adjusted R-squared	0.741277	S.D. dependent var	0.044140
S.E. of regression	0.022452	Akaike info criterion	-4.660261
Sum squared resid	0.009073	Schwarz criterion	-4.560688
Log likelihood	48.60261	F-statistic	55.43756
Durbin-Watson stat	1.272146	Prob(F-statistic)	0.000001

In order to test the second hypothesis stating that BERD has the highest influence on high technology exports share of Turkey compared to GOVERD and HERD, three regression models are established.

Table 5.9 shows the impact of business R&D expenditures on export performance. The tail probability prob (0.000) and prob(F-statistic) (0.0000) values show that both the variable and the model are statistically significant. The model has a sufficient explanatory power with an R^2 of 77%. The coefficient 0.45 shows that 1 unit (percent) increase in business R&D expenditures results in a 0,45 unit increase in export share of Turkey in OECD high technology exports.

Table 5.8: Estimates of BERD's Effects on High Tech Exports Share of Turkey (1990-2009)

Dependent Variable: HIGH TECH EXPORTS SHARE
Method: Least Squares
Sample (adjusted): 1990 2009

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BERD	0.450501	0.056924	7.914048	0.0000
C	0.017738	0.009870	1.797082	0.0891

R-squared	0.776764	Mean dependent var	0.086031
Adjusted R-squared	0.764362	S.D. dependent var	0.044140
S.E. of regression	0.021427	Akaike info criterion	-4.753723
Sum squared resid	0.008264	Schwarz criterion	-4.654150
Log likelihood	49.53723	F-statistic	62.63215
Durbin-Watson stat	1.142108	Prob(F-statistic)	0.000000

Table 5.10 shows the effect of government R&D expenditures on export share of Turkey. The tail probability prob (0.0004) and prob (F-statistic) (0.0004) values show that that both the variable and the model are statistically significant.Although, the coefficient is very high (1,33) stating that 1 unit (percent) increase in GOVERD results in a 1,33 unit (percent) increase in high technology exports share, R^2 is very low (51%) for explaining the relation between the variables, so the model show that government R&D expenditures in Turkey do not show a strong relation with the high technology exports.

Table 5.9: Estimates of GOVERD's Effects on High Tech Exports Share of Turkey (1990-2009)

Dependent Variable: HIGH TECH EXPORTS SHARE
Method: Least Squares
Sample (adjusted): 1990 2009
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GOVERD_	1.334810	0.278975	4.784696	0.0001
C	0.025856	0.021560	1.199248	0.2460

R-squared	0.510955	Mean dependent var	0.086031
Adjusted R-squared	0.483786	S.D. dependent var	0.044140
S.E. of regression	0.031714	Akaike info criterion	-3.969499
Sum squared resid	0.018104	Schwarz criterion	-3.869925
Log likelihood	41.69499	F-statistic	18.80644
Prob(F-statistic)	0.000397	Durbin-Watson stat	0.751012

Table 5.10 shows the effect of higher education R&D expenditures on export share of Turkey. The tail probability prob (0.0001) and prob (F-statistic) (0.000113) values show that that both the variable and the model are statistically significant. Although, the coefficient is quite high (0,50) stating that 1 unit (percent) increase in HERD results in a 0,50 unit (percent) increase in high technology exports share, R^2 is low (57%) for stating a statistically significant relation between the two variables.

Table 5.10: Estimates of HERD's Effects on High Tech Exports Share of Turkey (1990-2009)

Dependent Variable: HIGH TECH EXPORTS SHARE
Method: Least Squares
Sample (adjusted): 1990 2009

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HERD	0.508380	0.103530	4.910445	0.0001
C	-0.053753	0.029228	-1.839074	0.0825

R-squared	0.572573	Mean dependent var	0.086031
Adjusted R-squared	0.548827	S.D. dependent var	0.044140
S.E. of regression	0.029649	Akaike info criterion	-4.104170
Sum squared resid	0.015823	Schwarz criterion	-4.004596
Log likelihood	43.04170	F-statistic	24.11247
Durbin-Watson stat	1.115101	Prob(F-statistic)	0.000113

The models that explore the effect of GOVERD, BERD and HERD on high technology exports share of Turkey shows that although the coefficients, which shows that strength of the relation, are higher for GOVERD and HERD, $R^2$are not high enough to state a statistically significant relation between the variables. The changes in these two explanatory variables can explain around 50% of the changes in high technology exports. BERD, on the other hand, has a serious impact on export performance with a R^2 of 77%. The results of the three models accepts the second hypothesis.

The third hypothesis is tested due to the fact that effects of R&D efforts on the share of high tech exports can be effective in the following periods rather than the same time period because the mechanism that includes the transformation of R&D expenditures into the goods sold in the market can be completed in longer periods. In order to test H_3, lagged R&D expenditures are used in the models. Since each model is build with 1, 2 and 3 period lagged explanatory variables, the model results (12 models) are not showed on the study.

The models including lagged versions of GERD show that the effect of GERD on high tech exports do not change in the lagged models (the coefficient do not change) but the explanatory power of the models seriously diminish because R^2 of the models are decrease to below 50% as the lag increase.

The models estimating the impact of lagged versions of BERD on high tech exports performance show similar results with BERD. Although the coefficient slightly increase in the 1 lagged model, the explanatory power of the models decrease as the lag period increases. When the relation between the high tech exports and the lagged versions of GOVERD and HERD are observed, it is seen that the models still do show a statistically significant relation with export performance. As the lag period increases, the explanatory power of the models decreases further to the 30-40% levels. The lagged models are established in order to test H_3stating that lagged R&D expenditures affects export performance due to the transformation process of knowledge into goods. The model results show that both the overall and sectoral R&D expenditures do not have a statistically significant impact in the lagged time periods.

CHAPTER 6: CONCLUSIONS AND POLICY IMPLICATIONS

This study aims to answer two questions regarding the suitability of Lisbon Strategy for the economic development of Turkey based on technology and increased international competitiveness. The first question asks how meaningful the R&D targets mentioned in the Lisbon Strategy are for increasing competitiveness. In order to answer this question, a regression analysis is applied and the statistical significance and the degree of impact of the indicators are tested empirically. The second question asks how successful is Lisbon Strategy itself for governing the process and providing power to the countries for showing high progress. In order to answer this question, the performance of the EU member states, in reaching the R&D targets, is measured both overall and individually. While answering these questions, first, the concept of research and development (R&D) and competitiveness are examined. Secondly, R&D policies in Turkey and main instruments and objectives of the Lisbon Strategy are summarized.

According to the definition of Frascati Manual, defining an activity as R&D depends on the systematic effort and the innovation that adds something new to the stock of knowledge. Competitiveness does not have a common definition due to different aspects and methodological measurement difficulties such as the differences of the competitors (country vs. firm), or the framework (domestic vs. international). Nevertheless, in order to have a broad perspective and find a definition and indicator that can be applied in the context and aim of this study, formal documents, studies and reports of European Commission, OECD, World Economic Forum, International Institute for Management Development and national and federal councils on competitiveness are reviewed.

Considering these resources, it can be said that competitiveness is perceived as a “multi dimensional concept”. There is a common view that economy has various aspects related with different stakeholders who are all important and complementary. Neverthless, when the definitions and main objectives are considered the competitiveness can be defined as the practices, institutions and factors used for sustained increase in productivity and prosperity of a country.

Beside the term competitiveness, some studies use the term “international competitiveness” in order the compare the competitiveness of a sector or country relatively to others in global markets. The definitions used by European Commission, OECD and related academicians show that international competitiveness is the relatively position of a country in international markets based on exports performance.

In order to understand the road to Lisbon Strategy, the widening gap in GDP levels of USA and EU which is composed of the employment and productivity differences between the two rivals 1990s should be examined. Industrial policy is mentioned in a Treaty in EU first time in “Treaty for European Union” in 1992. Following the Treaty, European Commission and the Council published communications and decisions to establish an action plan including main objectives and instruments for increasing competitiveness. Lisbon Strategy was established at March 2000 European Council in Lisbon with the aim of making Europe “*the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion*”. Technological progress as a factor of productivity and the so called “new economy” rising in USA led to the objective of becoming a “knowledge based economy” in the Strategy. Also, problems in labour market in terms of securing jobs and increasing competitiveness at the same time and increasing the participation of older workers against the effects of “ageing” of population lead to establishment of the terms “flexicurity” and “life cycle” approaches of the Lisbon Strategy. When the goals and instruments of the Lisbon Strategy are compared with the reports of the Commission and the Council in 1990s, it can be concluded thatLisbon Strategy has been used as an overall “framework”for the enlarging acquis covering the action plans and instruments designed for adaptationto the new economic environment and challenges.

Due to main problems of governance of the Strategy such as, existence of so many targets and objectives, lack of clearance in the responsibilities of national and European actors, difficulty for member states to prepare various policy-specific reports, lack of public communication, lack of national ownership and political will etc, Lisbon strategy was tried to be improved starting from the basic goals and governance

mechanisms. In 2005, the Strategy was renewed by highly inspiring from the two reports of the independent groups chaired Win Kok and Andre Sapir. Despite the revision that reduce the indicators (from 42 to 14), increased focus on the main objectives and encouraging member states for taking more initiative, the Strategy is still criticized for the lack of political will and instruments that can enforce member states to fulfil their responsibilities, "one size fits all" approach that puts the same priorities for all member states.

In order to reply first question of this Study, asking how successful the Lisbon Strategy is in supporting the member states for reaching the goals, the overall performance of EU and member states individually are observed since 2000 while emphasizing the individual performance of emerging member states, having similar economic structures with Turkey. Regarding the overall performance, the striking conclusion is the clear transition to multi-polar world in terms of R&D efforts and output. The Asian countries namely China, Korea, and to some extent Japan, have been experiencing a remarkable progress. On the other side, EU and US are losing ground in main indicators. Compared to US, EU is said to be in a worse situation since US has specialization is some fields that the developing Asian countries have not entered yet. Also, US still have a dynamic business environment and attracting world class researchers from all over the world unlike EU.

As the second aspect of the Lisbon Benchmarking, the progress in individual member states is observed. The conclusion can be summarized as variety in terms of different indicators. Although, all member states are pursuing the same goals under the same strategy, the results show different trends which is, indeed, interpreted in many studies as the 'Mixed Lisbon Picture'. The differences in the performances can not be only separated as developed and developing member states.In contrast, the new member states show significant differences in R&D performance. Another difference is based on the indicators. For example, some new member states are good performers in gross domestic expenditures; however, the same countries show a very insufficient performance in business contribution to R&D due to the economic structures. Putting these conclusions together, it can be said that the Lisbonperformance do not have the

strength to pull the countries ahead and provide convergence but the performance too much depends on the countries ownership and efforts.

Before exploring the relation between R&D expenditures and international competitiveness represented by high technology exports share of Turkey in OECD, production and international trade structures in Turkey is reviewed in order to examine how R&D can have a positive impact on the recent conjuncture. SITC Rev. 3 is applied for sectoral classification and goods are separated into 9 sectors. The data showed that manufacturing sector (Sections 5,6, 7 and 8) represents %80 of total exports and % 76 of total imports. The most important export sections are 'machinery and transport equipment' and 'manufactured goods classified chiefly by material'. These two sections is equal to half of total exports. The highest proportion of imports belongs to 'machinery and transport equipment' while the rest is mostly shared by the 'manufactured goods classified by material', 'chemicals and related products' and 'mineral fuels and lubricants'. These sectors produce high value added products and the high technology products are generally included in these sectors, (mostly Sections 5 and 7) according to SITC classification.

In the highlighted sections of 5, 6, 7 and 8, there is a significant trade deficit around 14 billion dolar. The more important issue than the amount of deficit is the sectors that the deficit comes from. According to the table, the highest trade deficits occur in Sections 5 and 7 which includes most of the high technology products. Although the 'machinery and transport equipments' section has the highest share in exports, this section has the highest trade deficit. Also, although there is a trade surplus in 'manufactured goods classified by material' and 'miscellaneous manufactured articles', these sections include products such as leather, wood, textile, paper manufactures and iron and steel, furniture, footwear etc. which have relatively lower technology and value added. Although iron and steel sector is a significant sector in many aspects, the production in Turkey is based on long steel rather than flat steel which include higher level of technology. Putting these together, it can be said that significant reforms should be made in production and international trade that is going to change the trade balance both in total amount and, more importantly, in the sectoral

aspects. The manufacturing sector, sections 5 and 7 in particular, should be made more competitive and more attention should be given to the sectors under these sections.

Due to the need for structural reforms in production and international trade structure and economic growth plans based on export performance, "Exports Oriented Production Strategy Assesment Board" was established.The Board is composed of executives from related ministries and institutions such as TUBITAK, TOBB etc. Under the supervision of the Board, Ministry of Economy has established the "Input Supply Strategy (GITES)". GITES plans to provide supply of raw materials within Turkey by developing infrastructure and technical processes in mining sector beside supporting concentration plants to produce complex materials. For the products which can not be obtained within Turkey, increasing investments abroad similar to the implementation of China's mining investments in Africa is projected. Half of the intermediate good imports and the lowest rate of domestic good usage occurs in automotive sector and there is a definite import dependence from engines to electronics and software of the automobiles. The main mechanism of GITES against these problems is mentioned as efforts to increase cooperation between automotive and electronic sectors. In parallel with this objective, meetings have been organized in Ministry of Economy that gathers representatives from different sectors as a part of the cooperation efforts. For example, increasing contribution of defence industry, as a more developed sector especially in parts such as vehicle electronics, to automotive sector is one of such efforts.

In order to reply the second question of the study, asking how meaningful the Lisbon targets are for increasing competitiveness, regression analysis are applied and the statistical significance and the degree of impact of the indicators are tested empirically.The empirical study is based on country-level data of Turkey for the period from 1990 to 2009. The high technology exports of Turkey as a % of world high tech exports is taken as measure of international competitiveness while overall and sectoral R&D expenditures are used as explanatory variables. Due to high correlation between the independent variables, the impact of explanatory variables are tested with separate models. Empirical validity of the series and models are tested by diagnostic testsfor .$H_1$is tested in order to explore the impact of the overall R&D expenditures on export

performance. $H_2$is tested for comparing strength of the relations at sectoral basis. Finally, $H_3$is tested for exploring the relation between the variables in the lagged periods due to the time needed for transformation process of knowledge.

H_1: Turkey's overall R&D expenditures (GERD) has an influence on its high technology exports share.

H_2: Business R&D expenditures (BERD) has the highest influence on high technology exports share of Turkey.

H_3: R&D expenditures has an influence on high technology exports share in lagged periods.

The model estimating the impact of GERD on export performance shows that changes in GERD affects high technology exports share by approximately 20% which can be stated as a serious relation considering all factors affecting exports. The model results accepts H_1which claims that GERD has an influence on high technology exports share of Turkey.

The models estimating the relation between sectoral R&D expenditures and export performance show that BERD is the only variable that has a statistically strong impact on international competitiveness. The coefficient of the model of BERD is 0,45 which shows a higher impact than the overall R&D expenditures. On the other hand, government and higher education expenditures can only explain half of the changes in high technology exports share which is not accepted as a sufficient statistically. According to these results, H_2 can be accepted.Considering the fact that BERD has a serious impact on international competitiveness together with recent production in Turkey is based on import of intermediate products which creates a fragile economic structure,internalizing R&D and increasing investments can be stated as a tool to eliminate chronic current account problem.

The hypothesis claims that lagged R&D expenditures have impact on export performance. The model results show that both the overall and sectoral R&D

expenditures do not have a statistically significant impact in the lagged (up to 3 periods) time periods. According to the model findings, H_3 is rejected.

The production and international trade structure of Turkey shows that the sectors that includes most of high technology products has the highest trade deficit although in these sectors a high amount of exports is realized. The recent strategies states that such a trade balance is due to import of intermediate goods with high technologic background. This study aims to examine Lisbon Strategy as a model to improve trade structure of Turkish economy. Performance of EU countries in the last 10 years shows that Lisbon Strategy could not succeeded to accelerate member states for economic development mostly due to governance problems. On the other hand, empirical findings proves that despite the failure of Lisbon Strategy as a policy, the R&D expenditures that are targeted in the Strategy have a statistically significant impact on international competitiveness which is represented by high technology exports share of Turkey in OECD in the models. Also, the sectoral analysis proves that R&D expenditures of private sector has stronger relation with export performance than government or higher education expenditures. In the light of these evidences, this study suggests that private sector should be more active in R&D investments targeting technology production and the role of government should be motivating and directing private sector for such investments with suitable policies rather than performing investments. These policies can be established to complement GITES which focus on the recent problem of high intermediate goods import. The most efficient ways for making high technology production investments based on the findings of GITES,whom details are subject to further studies, should be the main goals of these policies. The second policy implication of this study is based on the fact that higher education R&D expenditures do not show a statistically significant relation with high technology exports. Although it is a fact that an important part of the research done in universities is basic research which do not seek the goal of commercialization, the lack of impact on export performance can not be fully explained by this fact. The weak university-industry linkage can be stated as one of the reasons that weakens the impact of HERD on exports. When the applications in diferent countries are observed, it is seen that companies established with both public and private sector capital aiming to support

commercialization of patents and ideas occurred in universities and other institutions. To strenghten HERD's impact on export peformance, such companies that act as venture capital can be one of the solutions.

REFERENCES

Aho, Esko, (2006), **Creating an Innovative Europe**,http://ec.europa.eu/invest-in-research/action/2006_ahogroup_en.htm

Boltho, Andrea, (1996), "The Assesment: International Competitiveness", **Oxford Review of Economic Policy**, Vol. 12, No. 3 http://oxrep.oxfordjournals.org/content/12/3/1.full.pdf+html

Bhagwati, Jagdish, (1989), "Is Free Trade Passé After All?", Ed. Jagdish, Bhagwati,**Political Economy and International Economics**.

Centre for European Reform, (2010), **Lisbon Scorecard X:The Road to 2020**, http://www.cer.org.uk/pdf/rp_967.pdf

Council on Competitiveness, (2006), **Competitiveness Index: Where America Stands**, http://www.isc.hbs.edu/pdf/Competitiveness_Index_2007.pdf

Deloitte & Council on Competitiveness, (2010), **2010 Global Manufacturing Competitiveness Index**.http://www.compete.org/images/uploads/File/PDF%20Files/2010_Global_Manufacturing_Competitiveness_Index_FINAL.pdf

Delegation of the European Commission to Turkey, (2007) "Science and Research Chapter: Negotiations and Current Status", **EU Turkey Review**, Winter 2007-2008, No:10. http://www.avrupa.info.tr/Files/File/AB-Gorunum/Sayi-10/gorunum-10-tr.pdf

DTM, (2011a), **Input Supply Strategy**, http://www.aso.org.tr/b2b/haber/haberoku.php?haber_no=2793

DTM, (2011b), **Input Supply Strategy Meeting**, http://www.dtm.gov.tr/dtmweb/bakanHaberDetay.cfm?haberNo=1410

Employment Committee, (2009), **Employment Guidelines: Indicators for Monitoring and Analysis**. http://ec.europa.eu/social/BlobServlet?docId=3643&langId=en

European Central Bank (2008), "Benchmarking the Lisbon Strategy", **European Central Bank Occasional Paper Series**, No:85. http://www.ecb.int/pub/pdf/scpops/ecbocp85.pdf

EU Commission, **Open Method of Coordination**, May 21, 2011. http://ec.europa.eu/invest-in-research/coordination/coordination01_en.htm#1

European Commission, **Better Regulation for New Technologies**, May 21, 2011. http://ec.europa.eu/invest-in-research/policy/regulation_tech_en.htm

EU Commission, (1994), **An Industrial Competitiveness Policy for the EU, Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions**. COM (1994) 319 Final. http://aei.pitt.edu/5532/1/002038_1.pdf

European Commission, (1997), **Benchmarking –Implementation of an Instrument Available to Economic Actors and Public Authorities,**COM (1997) 153 Final.http://eur-lex.europa.eu/Result.do?T1=V5&T2=1997&T3=153&RechType=RECH_naturel&Submit=Search

European Commission, (1999a), The Competitiveness of European Industry – 1999 Report, **Working Document of European Commission**. http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=6230f

European Commission, (1999b), **The Competitiveness of European Enterprises in the Face of Globalisation – How It Can Be Encouraged**, COM (1997) 718 Final. http://ec.europa.eu/research/pdf/com98-718en.pdf

European Commission, (2000), "European Competitiveness Report 2000", **Commission Staff Working Paper**, SEC (2000) 1823.http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=6231

European Commission, (2001a), “European Competitiveness Report 2001”, **Commission Staff Working Paper**, SEC (2001) 1705.http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=6232

European Commission, (2001b), **Structural Indicators**, COM (2001) 619 Final.http://ec.europa.eu/invest-in-research/pdf/download_en/comm_structural_indicators.pdf

European Commission, (2002),**More Research for Europe Towards 3% of GDP**, COM (2002) 499 Final. http://ec.europa.eu/research/era/pdf/com3percent_en.pdf

Euroean Commission, (2003b), **Structural Indicators**, COM (2003) 585 Final. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0585:FIN:EN:PDF

EU Commission, (2004a), **2004 Regular Report on Turkey’s Progress Towards Accession**, COM (2004), 656 Final.http://ec.europa.eu/enlargement/archives/pdf/key_documents/2004/rr_tr_2004_en.pdf

European Commission, (2004b), “Delivering Lisbon: Reforms for the Enlarged Union”, **Report from the Commission to the Spring European Council**. COM (2004), 29 Final.http://collection.europarchive.org/dnb/20070702132253/http://ec.europa.eu/growthandjobs/pdf/COM2004_029_en.pdf

European Commission, (2005a), “The Economic Costs of Non-Lisbon: A Survey of the Literature on the Economic Impact of Lisbon-type Reforms”, **European Commission Occasional Papers**, No: 16.http://ec.europa.eu/economy_finance/publications/publication966_en.pdf

European Commission, (2005b), **Implementing the Community Lisbon Programme: More Research and Innovation - Investing for Growth and Employment: A Common Approach** , COM (2005) 488 Final.http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0488:FIN:en:PDF

European Commission, (2005c), **Working Together for Growth and Jobs, A New Start for the Lisbon Strategy, Communication to the Spring European Council**, COM (2005) 24 Final.http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0024:FIN:en:PDF

European Commission, (2005d), **Lisbon Action Plan Incorporating EU Lisbon Programme and Recommendations for Actions to Member States for Inclusion in their National Lisbon Programmes**, SEC (2005) 192.http://www.eurometrex.org/Docs/Meetings/nurnberg_2005/EC_Lisbon_Action.pdf

European Commission, (2006), **Delivering on the Modernisation Agenda for Universities: Education, Research and Innovation, Communication from the Commission to the Council and the European Parliament**, COM (2006) 208 Final.http://www.ihep.org/assets/files/gcfp-files/Delivering_Modernisation_Agenda_for_Universities_Education_Research_and_Innovation_May_2006.pdf

European Commission, (2007), **Towards Open and Systemic Research and Innovation Policies for Europe Trends in the National Reform Programmes, 2nd Interim Report of the Lisbon Expert Group**.http://ec.europa.eu/invest-in-research/pdf/download_en/leg_report2_final.pdf

EU Commission, (2008a), "European Innovation Scoreboard 2007", **Pro Inno Europe Papers**No:6.http://www.proinno-europe.eu/page/european-innovation-scoreboard-2007

European Commission, (2008b), **A More Research-Intensive and Integrated European Research Area: Science, Technology and Competitiveness Key Figures Report 2008/2009**. http://ec.europa.eu/research/era/pdf/key-figures-report2008-2009_en.pdf

European Commission, (2009a), **EU Industrial Structure 2009: Performance and Competitiveness**.http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=5580

EU Commission, (2009b), "Turkey 2009 Progress Report", **Commission Staff Working Document**, COM (2009), 533.http://ec.europa.eu/enlargement/pdf/key_documents/2009/tr_rapport_2009_en.pdf

European Commission, (2010a), European Competitiveness Report 2010: An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Front Stage,**Commission Staff WorkingDocument**, SEC (2010) 1276 Final.http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=6222

European Commission, (2010b), "Lisbon Strategy Evaluation Document", **Commission Staff Working Document**, SEC (2010) 114 Final.http://ec.europa.eu/europe2020/pdf/lisbon_strategy_evaluation_en.pdf

European Council, (1996), **Council Decision of 25 June 1996 on the Implementation of a Community Action Programme to Strengthen the Competitiveness of European Industry**, 94/413/EC.http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996D0413:EN:HTML

European Council. (2000), **Lisbon European Council 23 and 24 March Presidency Conclusions**.http://www.europarl.europa.eu/summits/lis1_en.htm#a

European Council, (2002), **Barcelona European Council 15 and 16 March 2002 Presidency Conclusions**.http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/71025.pdf

European Council, (2005), **European Council 22 and 23 March 2005 Presidency Conclusions**.http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/84335.pdf

European Council, (2008), **Council Decision on Guidelines for the Employment Policies of the Member States**, 2008/618/EC. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:198:0047:0054:EN:PDF

European Council (2010),**Consolidated Version of the Treaty on the Functioning of the European Union,**C 83/ 30.3.2010. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:083:0047:0200:EN:PDF

Eurostat, **Statistics on Research and Development: Reference Metadata**.http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/rd_esms.htm

Eurostat, (2010a), **Science,Technology and Innovation in Europe**.http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-EM-10-001/EN/KS-EM-10-001-EN.PDF

Eurostat, (2010b), **EU Economic Data Pocketbook/ 2-2010**. http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-CZ-10-002/EN/KS-CZ-10-002-EN.PDF

Gelauff, G. and Lejour, A. (2006), "Five Lisbon Highlights: The Economic Impact of Reaching These Targets", **CPB Netherlands Bureau for Economic Policy Analysis Document**, No: 104.http://www.cpb.nl/sites/default/files/publicaties/download/five-lisbon-highlights-economic-impact-reaching-these-targets.pdf

Global Federation of Competitiveness Councils, (2010), **2010 Global Competitiveness Principles**.http://www.thegfcc.org/

Goksel, Nilüfer K.,**Türkiye'de Bilim ve Teknoloji Politikalarının Gelişimi ve Teknoloji Transferi**.http://www.dtm.gov.tr/dtmadmin/upload/EAD/TanitimKoordinasyonDb/turkiye.doc

Goodwin, Neva and Nelson, Julie, (2009), **Microeconomics in Content**, Second Edition. http://books.google.com.tr/books?id=P3e-7w_-ed0C&printsec=frontcover&hl=tr&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Gujarati, D. N., (2004), **Basic Econometrics**, Fourth Edition, McGraw−Hill Companies.

Hughes, Kirsty, (1986), **Exports and Technology**, Cambridge University Press.

Hughes, Kirsty, (1993), "The Role of Technology, Competition and the Skill in European Competitiveness", Kirsty Hughes (Ed.),**European Competitiveness**, Cambridge University Press.

Institute for Management Development, (2010), **IMD World Competitiveness Yearbook 2010**.http://www.imd.org/research/publications/wcy/upload/methodology.pdf

Korea Development Institute, (2009),**Models for National Technology and Innovation Capacity Development in Turkey**.http://www.ttgv.org.tr/content/docs/final-report_turkey-ksp.pdf

Krugman, Paul, (1979), "A Model of Innovation, Technology Transfer, and the World Distribution of Income", **The Journal of Political Economy**, Vol. 87, No. 2.

Krugman, Paul, (1987), "Is Free Trade Passé?",**Journal of Economic Perspectives**, Vol. 1, No.2.

Krugman, Paul, (2001), "Competitiveness: A Dangerous Obsession", **Foreign Affairs**, Vol. 73, No:2. www.ucema.edu.ar/~agaletto/krugman_competitiveness.pdf

Krugman, Paul and Obstfield, Maurice, (2005), **International Economics**, Seventh Edition, Pearson International Edition.

OECD, **Glossary of Statistical Terms**. http://stats.oecd.org/glossary/detail.asp?ID=399

OECD, (1996), "Globalisation and Competitiveness: Relevant Indicators", **OECD Science,Technology and Industry Working Papers, 1996/5.**http://www.oecd-ilibrary.org/docserver/download/fulltext/5lgsjhvj7nlw.pdf?expires=1305123009&id=id&accname=guest&checksum=6833F859B790265B157A5186E9111C8C

OECD, (2002), **Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental**

Development.http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/kilavuzlar/Frascati.pdf

OECD, (2005), **Handbook on Economic Globalization Indicators**.http://www.realinstitutoelcano.org/materiales/docs/OCDE_handbook.pdf

OECD, (2006), **Science, Technology and Industry Outlook 2006**.http://www.oecd.org/document/62/0,3746,en_2649_34273_37675902_1_1_1_1,00.html

OECD, (2007), **Science, Technology and Industry Scoreboard 2007: Innovation and Performance in the global Economy**.http://www.oecd.org/dataoecd/43/24/40305816.pdf

OECD, (2009), **Science, Technology and Industry Scoreboard 2009**.http://www.oecd.org/document/26/0,3343,en_2649_33703_39493962_1_1_1_1,00.html

Official Journal, (2010), **Exports Oriented Production Strategy Assesment Board**.http://www.resmigazete.gov.tr/eskiler/2010/05/20100512-4.htm

Posner, M. V. (1961), "International Trade and Technical Change", **Oxford Economic Papers**, Vol 13, No:3.

Pottelsberghe, Bruno Van, (2008), "Europe's R&D: Missing the Wrong Targets", **Bruegel Policy Brief**, 2008/3.
http://www.bruegel.org/publications/publication-detail/publication/7-europes-r-and-d-missing-the-wrong-targets/

Romer, Paul (1990), "Endogenous Technological Change", **The Journal of Political Economy**, Vol. 98, No. 5.

Salvatore, Dominic, (2005), **Introduction to International Economics**, Wiley&Sons, First Edition

Sapir, Andre (2003), **An Agenda for a Growing Europe: Making the EU Economic System Deliver**.www.euractiv.com/ndbtext/innovation/sapirreport.pdf

Solow, Robert, (1956), "A Contribution to the Theory of Economic Growth", **Quarterly Journal of Economics**, Vol. 70, No. 1.

Solow, Robert (1957), "Technical Change and the Aggregate Production Function", **The Review of Economics and Statistics**, Vol. 39, No. 3.

State Planning Organisation,(1963), **Kalkınma Planı (Birinci Beş Yıl),**http://ekutup.dpt.gov.tr/plan/plan1.pdf

State Planning Organisation, (1968), **İkinci Beş Yıllık Kalkınma Planı,**http://ekutup.dpt.gov.tr/plan/plan2.pdf

State Planning Organisation, (1973),**Üçüncü Beş Yıllık Kalkınma Planı,**http://ekutup.dpt.gov.tr/plan/plan3.pdf

State Planning Organisation, (1979), **Dördüncü Beş Yıllık Kalkınma Planı**, http://ekutup.dpt.gov.tr/plan/plan4.pdf

State Planning Organisation, (1985), **Beşinci Beş Yıllık Kalkınma Planı**, http://ekutup.dpt.gov.tr/plan/plan5.pdf

State Planning Organisation, (1990), **Altıncı Beş Yıllık Kalkınma Planı**, http://ekutup.dpt.gov.tr/plan/plan6.pdf

State Planning Organisation, (1996), **Yedinci Beş Yıllık Kalkınma Planı**, http://ekutup.dpt.gov.tr/plan/vii/

State Planning Organisation, (2000), **Sekizinci Beş Yıllık Kalkınma Planı**, http://ekutup.dpt.gov.tr/plan/plan8.pdf

State Planning Organisation, (2004), **Ön Ulusal Kalkınma Planı**, http://ekutup.dpt.gov.tr/plan/o-ukp.pdf

State Planning Organisation, (2006), **Dokuzuncu Beş Yıllık Kalkınma Planı**, http://ekutup.dpt.gov.tr/plan/plan9.pdf

Thurow, Lester C. (1994), "Microchips, Not Potato Chips", **Foreign Affairs**, Vol. 73, No: 4.http://www.foreignaffairs.com/articles/50110/lester-c-thurow/microchips-not-potato-chips

TÜBİTAK, **Supreme Council for Science and Technology**.http://www.tubitak.gov.tr/sid/1003/pid/547/index.htm

TUBITAK, **Teknoloji Platformları**, http://www.tubitak.gov.tr/sid/909/pid/900/index.htm

TUBITAK, **Turkish Research Area**.http://www.tubitak.gov.tr/sid/1004/pid/547/index.htm

TUBITAK, (2004), **2003-2023 Strategy Document**. http://www.tubitak.gov.tr/tubitak_content_files//vizyon2023/Vizyon2023_Strateji_Belgesi.pdf

TÜBİTAK, (2010), **The Republic of Turkey's Model of Instigating an STI Impetus**.http://www.tubitak.gov.tr/tubitak_content_files//BTYPD/arsiv/Special_Brief_Guncel19_Web.pdf

US Department of Commerce, (1998), **The Emerging Digital Economy**. http://govinfo.library.unt.edu/ecommerce/EDEreprt.pdf

World Economic Forum, (2008), **The Lisbon Review 2008: Measuring Europe's Progress in Reform.**

World Economic Forum, (2010), **The Global Competitiveness Report 2010–2011**.http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2010-11.pdf

APPENDIX: DEPENDENT AND INDEPENDENT VARIABLES

High Technology Exports of Turkey as a % of OECD High Tech Exports (1989-2009)

1989	0,04
1990	0,03
1991	0,03
1992	0,03
1993	0,04
1994	0,05
1995	0,04
1996	0,05
1997	0,07
1998	0,07
1999	0,12
2000	0,13
2001	0,13
2002	0,07
2003	0,10
2004	0,11
2005	0,09
2006	0,12
2007	0,15
2008	0,15
2009	0,15

Source: Worldbank Database.http://data.worldbank.org/

Gross Domestic Expenditure on R&D in Turkey between 1990 and 2009 (% of GDP)

1990	0,24
1991	0,39
1992	0,36
1993	0,33
1994	0,27
1995	0,28
1996	0,34
1997	0,37
1998	0,37
1999	0,47
2000	0,48
2001	0,54
2002	0,53
2003	0,48
2004	0,52
2005	0,59
2006	0,58
2007	0,72
2008	0,73
2009	0,85

Source: OECDStatistics Database.http://stats.oecd.org

Business Enterprise R&D Expenditure in Turkey between 1990 and 2009 (% of GDP)

1990	0,05
1991	0,08
1992	0,09
1993	0,08
1994	0,07
1995	0,07
1996	0,09
1997	0,12
1998	0,12
1999	0,18
2000	0,16
2001	0,18
2002	0,15
2003	0,11
2004	0,13
2005	0,20
2006	0,21
2007	0,30
2008	0,32
2009	0,34

Source: OECDStatistics Database.http://stats.oecd.org

Government R&D Expenditures in Turkey between 1990 and 2009 (% of GDP)

1990	0,02
1991	0,03
1992	0,03
1993	0,03
1994	0,02
1995	0,02
1996	0,04
1997	0,04
1998	0,03
1999	0,03
2000	0,03
2001	0,04
2002	0,04
2003	0,05
2004	0,04
2005	0,07
2006	0,07
2007	0,08
2008	0,09
2009	0,11

Source: OECDStatistics Database.http://stats.oecd.org

Higher Education R&D Expenditures in Turkey between 1990 and 2009 (% of GDP)

1990	0,17
1991	0,28
1992	0,25
1993	0,22
1994	0,18
1995	0,20
1996	0,21
1997	0,21
1998	0,23
1999	0,26
2000	0,29
2001	0,32
2002	0,34
2003	0,32
2004	0,35
2005	0,32
2006	0,30
2007	0,35
2008	0,32
2009	0,40

Source: OECDStatistics Database.http://stats.oecd.org