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EVALUATION OF INNOVATIVENESS OF TURKEY WITH RESPECT TO EUROPEAN UNION INTEGRATION

MASTER THESIS

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The thesis is submitted by ***Aslı Tuncay*** to the Institute of Social Sciences of Işık University in partial fulfillment of MBA Degree approved by;

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SUMMARY

This thesis consists of four main parts. The first part presents information about the *definition* and *classification* of innovation. Product innovation, process innovation, technical innovation, administrative innovation, organizational innovation, radical innovation and incremental innovation are major headings in this part.

The second part of the thesis mainly focuses on *innovation process*. In addition to various innovation process methods, *Schumpeterian, Neo-Classical* and *Porter*'s approaches are studied and the basic of the National Systems of Innovation is presented.

The third part of the thesis includes *European Innovation Scoreboard 2002 (EIS)*. This scoreboard analyzes statistical data in four areas, which are human resources; knowledge creation; transmission and application of knowledge; innovation finance, output and markets. The scoreboard's statistical data are prepared for 21 indicators of innovation for each EU member states as well as 13 candidate countries including Turkey.

The fourth part concentrates on the analysis of innovation on *enlargement countries*. According to Innovation Scoreboard, the Candidate countries perform favorably compared to the EU for the share of the working-age population with tertiary education (with Bulgaria, Cyprus, Estonia and Lithuania equal to or above the EU mean), the employment share for high-tech manufacturing (with the Czech Republic, Hungary, Poland and Slovenia close to or above the EU mean), ICT expenditures (with the Czech Republic, Estonia, Hungary and Latvia close to or above the EU mean), and the stock of inward FDI (with the Czech Republic, Estonia, Hungary and Malta above the EU mean).

For 3 indicators, these candidate countries are above the best performing EU member state: Lithuania for both working-age populations with tertiary education and high-tech venture capital, and Malta for sales of 'new to market' products. Innovative capabilities in the Candidate countries are dominated by less than half of the

countries, with 88% of the leading slots taken by six countries: Estonia (8), the Czech Republic and Slovenia (7 each), Lithuania and Hungary (5 each), and Malta (4). Latvia occurs twice, and Cyprus, Slovakia and Turkey once. Poland, Romania and Bulgaria are never among the top three performing Candidate countries.

This thesis point outs some *unrevealed facts* of the Innovation Scoreboard 2002. The data, which are taken from EIS, originally developed in order to form the following tables: the comparison of the GDPs, population of candidate countries, business expenditure on R&D and public expenditure on R&D. Those figures yield that Turkey has the highest rank in GDP, population and public expenditure on R&D and second best in business expenditure on R&D.

The current performance and the results of *SWOT Analysis* of Turkey are also presented in the final part of the thesis. Turkey's SMEs innovating in house and new to market production are above the European Union mean. Public and business R&D in Turkey has good grades among all the indicators. In *SWOT* Analysis, the strengths, weaknesses, opportunities and threats in innovation point of view of Turkey are given.

The discussion about the results is summarized in the conclusion part of this thesis.

ÖZET

Bu tez toplam dört bölümden oluşmaktadır. İlk bölümde, inovasyonun tanımı yapılmakta ve türleri tanıtılmaktadır. Ürün inovasyonu, süreç inovasyonu, teknik inovasyon, yönetimsel inovasyon, örgütsel inovasyon, radikal inovasyon ve adımsal inovasyon bu bölümde anlatılan başlıklardır.

İkinci bölüm, süreç inovasyonu ile ilgilidir. Süreç inovasyonuna ek olarak; Schumpeter, Neo-Klasik ve Porter'in yaklaşımları ortaya koyulmuş ve ulusal inovasyon sistemleri anlatılmıştır.

Üçüncü bölüm Avrupa Birliği (AB) İnovasyon Sıralaması 2002'yi kapsamaktadır. Bu sıralamaya göre, istatistiksel veriler dört alanda analiz edilir: insan kaynakları; bilgi yaratma; bilginin iletilmesi ve uygulanması; finans inovasyonu, üretim ve piyasalar. Sıralama, tüm AB üyesi ülkeler ile Türkiye'nin de içinde olduğu 13 aday ülkenin, 21 adet inovasyon ölçütüne göre oluşmuş verilerinden oluşmaktadır.

Dördüncü bölüm, aday ülkelerdeki inovasyonunun analizi üzerine yoğunlaşmaktadır. İnovasyon sıralamasına göre, aday ülkelerde yaşayan yüksek okul mezunu çalışan nüfusun varlığı, AB ülkelerinin ortalamasına yakın bulunmuştur. Bulgaristan, Kıbrıs, Estonya ve Lituanya’da bu oran AB ortalamasına yakın veya üstündedir. İleri teknoloji alanında üretim yapan firmalarda çalışma oranı Çek Cumhuriyeti, Macaristan, Polonya ve Slovenya’da AB ortalamasına yakın veya üstünde; enformasyon teknolojilerine olan harcamalarda Çek Cumhuriyeti, Estonya, Macaristan ve Letonya’da AB ortalamasına yakın veya üstünde, doğrudan yatırım alanında ise Çek Cumhuriyeti, Estonya, Macaristan ve Malta, AB ortalamasına yakın veya üstünde sonuçlar göstermişlerdir.

Üç göstergede, aday ülkeler AB üye ülkelerinin de üzerinde en iyi performası göstermiştir. Litvanya hem yüksek okul mezunu çalışan nüfusun varlığı, hem de ileri teknoloji risk sermayesi bakımından; Malta ise pazara yeni sürülmüş ürünlerin satışı bakımından ileridedir. Aday ülkelerin inovasyon kabiliyetleri incelendiğinde, 88 % oranında ölçütün altı ülkece paylaşıldığı görülmüştür: Estonya (8), Çek Cumhuriyeti

ve Slovenya (7'şer), Litvanya ve Macaristan (5'şer) ve Malta (4). Letonya iki kere, Kıbrıs, Slovakya ve Türkiye bir kere aday ülkeler arasında ilk üç içinde yer almıştır.

Bu tez, İnovasyon Sıralaması 2002'ye ilişkin bazı değerlendirilmeye alınmamış noktaları ortaya koymaktadır. Veriler Avrupa İnovasyon Sıralama'sından alınmış ve özgün tablolar oluşturulmuştur: gayri safi milli hasılaların (GSMH) karşılaştırılması, aday ülkelerin nüfusları, özel sektör ve kamunun Ar-Ge harcamaları. Sonuçlara göre, Türkiye GSMH, nüfus ve kamu Ar-Ge harcamalarında birinci ve özel sektör Ar-Ge harcamalarında ikinci sırada bulunmaktadır.

Tezin son bölümünde, Türkiye'nin güncel inovasyon performansı incelenmiş, SWOT analizi yapılarak inovasyon bakış açısıyla Türkiye'nin güçlü ve zayıf yanları ile Türkiye'yi bekleyen fırsat ve tehtitler sunulmuştur. Türkiye'de bulunan KOBİ'lerin (küçük ve orta işletmeler) inovasyon faaliyetlerinde bulunması ve Türkiye'de üretimde bulunan tüm firmaların satış miktarı AB ortalamasının üzerindedir.

Tezin son bölümünde, sonuçlarla ilgili tartışma özetlenmektedir.

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ABBREVATIONS

A	Austria
B	Belgium
BERD	Business Expenditures on Research and Development
BG	Bulgaria
CH	Switzerland
CIP	Continuous Improvement Process
CIS	Community Innovation Survey
CY	Cyprus
CZ	Czech Republic
D	Germany
DK	Denmark
E	Spain
EE	Estonia
EIS	European Innovation Survey
EL	Greece
EPO	European Patent Office
EU	European Union
EUROSTAT	European Statistics
EVCA	European Private Equity and Venture Capital Association
F	France
FDI	Foreign Direct Investment
FIN	Finland
GDP	Gross Domestic Product
GERD	Total Research and Development Expenditures
GORD	Government Expenditures in Research and Development
HERD	Higher Education Expenditures in Research and Development
HU	Hungary
I	Italy

ICT	Information and Communication Technology
IRL	Ireland
IS	Iceland
IT	Information Technology
JIT	Just in Time
L	Luxembourg
LT	Lithuania
LV	Latvia
MT	Malta
MNEs	Multinational Enterprises
MT	Malta
NL	Netherlands
NO	Norway
P	Portugal
PL	Poland
PNRD	Private Non-Profit Expenditure in Research and Development
PPS	Purchasing Power Standards
R&D	Research and Development
RO	Romania
S	Sweden
S&E	Science and Engineering
SI	Slovenia
SK	Slovakia
SMEs	Small and Medium Sized Enterprises
TR	Turkey
UK	United Kingdom
UNCTAD	World Investment Report
USPTO	US Patent and Trade Mark Office

INTRODUCTION

Although *innovation* as a term had been used over the whole twentieth century, it is used most effective at the beginning of 21st century in management approaches, which means new ideas and products. According to the European Union, innovation policy should be understood as a set of policy actions to raise the quantity and efficiency of innovation activities, whereby innovative activities refer to the *creation*, *adaptation* and *adoption of new or improved products, processes or services* Tuncay (2003).

When the history of innovation is analyzed, there are two effective theories that describe the technological and innovation policies which are called *Neo-classical* and *Schumpeterian* theories. Neo-classical theory emerged for economy only, and it became insufficient to fulfill the requirements of recent technological innovations. The other theory, which is known as Schumpeterian/evolutionist theory become dominant after the 1980's.

The increase of the flow of information has put positive impact on the new product development process higher than ever. A research group may easily search for the innovations in their field of study in the digital world without wasting time. It is clear that technology increases the innovative movements, as well as research and development activities. Under this circumstance, every *individual*, *firms* and even *societies* have to be innovative.

In this sense, firms have to be innovative or else they will not be successful and soon they will fail. Firms have to produce more functional products with higher quality in their new product development processes.

In the following sections, the ***Innovation Scoreboard 2002*** will be used as a secondary data, which is published by the Commission of the European Communities. In this report, the European Union measured the degree of innovativeness by looking at the state policy of the member countries as well as enlargement countries. According to the European Union innovation scoreboard, states are being analyzed for many indicators.

The main objective of this thesis briefly presents various definitions of innovation, classifies and discusses their historical developments, and points out the recent progress to provide a scoreboard to compare the innovativeness of various countries. In this respect *The European Union Scoreboard* is taken as a fundamental approach, and this thesis focuses on Turkey’s innovativeness under European Union Scoreboard terms. Since figures are obtained own per capita basis, results are in favor of small population nations.

In the final part, Turkey’s innovativeness structure will be evaluated by the data available. A further study considering total quantities, instead of per capita considerations, will reveal very favorable results for Turkey. This will be summarized in the *Unrevealed Facts* section of this thesis. A *SWOT analysis* about Turkey’s innovativeness will be presented. This thesis will be completed with conclusive remarks as to whether Turkey is an innovative country or not.

PART I
GENERAL INFORMATION ABOUT INNOVATION

1.1 THE SCOPE OF INNOVATION

The word *"innovation"* means new ideas, processes and products. It is briefly a forward thinking attitude to newness. According to the ***European Union***, "Innovation policy should be understood as a set of policy actions to raise the quantity and efficiency of innovation activities, whereby innovative activities refer to the creation, adaptation and adoption of new or improved products, processes or services."[1] In this wide definition of the European Union, it is clearly seen that innovative activities only occur when a new product, process or a service is created or an already created product, process or service is converted to a new version.

In 1911, ***Schumpeter*** defined product innovation as "the introduction of a new good or a new quality of a good", and process innovation as "the introduction of a new method of production or a new way of handling a commodity commercially".[2] Schumpeter basically called a new product or process as innovation when they are being established as infants or as an improved form of already produced products or processes. Since Schumpeter mainly focused on products and commercial activities, the above definition is somehow incomplete. The role of his *Innovation System* in societies and the effect of the state in establishing innovative structures were omitted. Therefore, the importance of establishing innovative structures for the societies will be discussed in the following parts of the thesis.

In addition to the above landmark definition, ***Becker*** and ***Whisler*** described innovation as the first or early use of an idea by one of a set of organizations with similar goals.[3] In 1969, ***Myers*** and ***Marquis*** further defined innovation as a complex activity which proceeds from the conceptualization of a new idea to a solution of the

[1] Commission of The European Communities, "2001 Innovation Scoreboard", **Commission Staff Working Paper**, Brussels, SEC (2001) 1414, 2001, p.7
[2] Yuichi Shionoya, Mark Perlman, **Innovations in Technology, Industries and Institutions: Studies in Schumpeterian Perspectives**, Ann Arbor, The University of Michigan Press, Michigan, 1994, p.7.

problem, and then to the actual utilization of economic or social value. Innovation is not just the conception of a new idea, nor the invention of a new device, nor the development of a new market. The process is all of those things acting together in an integrated fashion.[4] On the other hand, ***Zaltman***, ***Duncan*** and ***Holbek*** defined innovation as a creative process whereby known concepts are combined in a unique way to produce a new configuration not previously known. In addition, it is any idea, practice or material artifact perceived to be new by the relevant unit of adoption.[5]

In 1983, innovation is defined by ***Kanter*** as the process of bringing any new problem-solving idea into use. Ideas for reorganizing, cutting costs, putting in new budgeting systems, improving communication, or assembling products in teams are also innovations. Innovation is the generation, acceptance, and implementation of new ideas, processes, products or services.[6] One year later, in 1984, ***Nicholson*** defined the role of innovation as the initiating of the changes in task objectives, methods, materials, scheduling and in the interpersonal relationships integral to task performance.[7] ***Drucker*** argues that successful entrepreneurs must use systematic innovation, which consists of the purposeful and organized search for changes, and in the systematic analysis of the opportunities such changes might offer for economic and social innovation.[8]

Burgelman and ***Sayles*** view innovation as a welding of marketplace opportunities with inventive technology and new technical knowledge. Invention is viewed as the creative act of the individually whereas innovation is a social process within the organization that follows invention.[9] According to ***Freeman***, innovation is the using of new knowledge to offer a new product or service that customers want. It is

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[3] Michael A. West, James L. Farr, **Innovation and Creativity at work: Psychological and Organizational Strategies**, John Wiley & Sons Ltd., England, 1990, p.9.
[4] Summer Myers, Donald D.Marquis, **Successful Industrial Innovations**, National Science Foundation, NSF, 1969, p.69-17.
[5] Gerald Zaltman, Robert Duncan, Johnny Holbek, **Innovations and Organizations**, John Wiley and Sons, London, 1973, p.10.
[6] Rosebeth Moss Kanter, **The Change Masters**, Simon and Schuster, New York, 1983, p.20.
[7] Nigel Nicholson, “A Theory of Work Role Transitions”, **Administrative Science Quarterly 29**, 1984, p.172-191.
[8] Peter Drucker, **Innovation and Entrepreneurship: Practice and Principles**, Heinemann, London, 1985, p.31.
[9] Robert A. Burgelman, Leonard R. Sayles, **Inside Corporate Innovation: Strategy, Structure, and Managerial Skills**, The Free Press, New York, 1986, p.41.

invention and commercialization.[10] Innovators have to consider the customer's point of view. ***Porter*** emphasizes innovation as a new way of doing things that is commercialized. The process of innovation cannot be separated from a firm's strategic and competitive context.[11] It is very important to analyze the structure of the firm so that one can develop the new strategies which are most appropriate. Porter's arguments will be presented in the next part in more detail. According to ***Kuczmarski***, "Innovation is accepted as a long-term investment organizations look forward to, for a future of sustained growth and continued prosperity and a key in order to gain competitive advantage."[12] In addition to that, Kuczmarski stated "innovation as a mindset- a new way to think about business strategies and practice. There is no doubt that innovative activities bring a highly competitive environment." This means better products and services should be revealed every time innovation arises. In order to be successful, innovativeness should be increased so that an individual, a company, or a society that innovates will be differentiated from the others. In this respect, the competitiveness of a firm in today's rapidly changing business environment depends on its capacity to innovate. To maintain competitive advantage and to sustain ongoing business improvement, the firm has to take action to implement a company wide process of continuous innovation.[13] ***West*** and ***Farr*** stated that innovation is the intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to relevant unit of adoption, designed to significantly benefit the individual, the group, organization or wider society. [14]

1.2 HISTORY OF INNOVATIVE MOVEMENTS

When the meaning of innovation is enlarged, it is seen that innovation can not always be achieved by firms. Order to get a broad overview of why innovation may or may

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[10] Chris Freeman, Luc Soete, **The Economics of Industrial Innovation**, MIT Press, Cambridge, 1982, p.7.
[11] Micheal Porter, **The Competitive Advantage of Nations**, Free Press, New York, 1990, p.780.
[12] Thomas Kuczmarski, "Innovation: Leadership Strategies for The Competitive Edge", **American Marketing Association**, NTC Publishing Group, Chicago, 1995, p.2.
[13] Sedef Akgüngör, Hatice Camgöz Akdağ, Aslı Tuncay, "Innovative Culture and Total Quality Management as a Tool For Sustainable Competitiveness: A Case Study of Turkish Fruit and Vegetable Industry", **1st Annual SME 2002 Conference Proceedings**, Eastern Mediterranean University, North Cyprus, 2002.
[14] West, op.cit., p.9.

not happen, it is important to look at the past events of innovative movements. In the very early days, humankind learned to control fire to cook and warm themselves, developed wheels to travel and containers to store food. At that time humans were living together as groups in other words they were forming tribes or clan groups.

In the very early days of humankind, it has been recognized that some groups developed technologically more quickly than the others. For example: *Sumerian writings* preserved on tablets of baked clay writing that ranged from trading and legal records to the so-called wisdom literature, which consists of philosophical reflections like the Proverbs.[15] This, no doubt, provided advantages on commerce to ***Sumerians*** and ***Assyrians***. History is full of examples to show how innovativeness affects societies. Another example is the use of various innovative war equipment and methods, which brought *superiority* to the users like ***Hittites'*** war chariots.

In general it is seen that innovative activities occur more frequently in societies or companies where expression of ideas is *free*, management methods are *liberal* and modern life standards are *adopted*. Although some inventors and inventions emerged in conditions and contrary to these assumptions and even they lost their lives, in general people could innovate if and only if the social environment permitted it. In history, there are numerous states which accepted non innovative closed systems. Their social nature, administrative and governmental structure, and their understanding of the religion might well have been the cause of this. ***Ottoman Empire*** may be an example of non innovative state in terms of its scholastic science approach.

According to ***Kogut***, ***Shan*** and ***Walker*** in 1993, new paradigms of industrial and spatial organization have emerged since the 1980's, manifesting regionalization rather than the integration of the world economy. This led to the reevaluation of the appropriateness of national responses to *regional problems*. In other words, the

[15]Anthony Atmore, Peter W. Avery, Harold Blakemore, Ernle Bradford, Warwick M. Bray, Raymond Carr, David Chandler, Leonard Cottrell, Terence Dalley, Raymond S. Dawson, Margaret S. Drower, C. J. Dunn, Micheal Edwardes, Robert Edwardes, Robert Erskine, Andrew M. Fleming, Nigel Hawkes, Douglas Hill, Ronald Hingley, Douglas W. J. Johnson, Geoffrey L. Lewis, Roger Morgan, Hugh Seton-Watson, Richard Storry, Geoffrey Trease, James Waldersee, Keith Ward, David M. Wilson, Maurice Wilson, Esmond Wright, **The Last Two Million Years**, Reader's Digest Association, London, 1973, p.54.

globalization of economic relations and the regionalization of trade are challenging the territorial and regulatory significance of national economic spaces, giving greater prominence to the nature and performance of individual regional and local economies within nations (***Dunford*** and ***Kafkalas*** 1992). The gravitational center of the economy shifted to the sub national scale: *the firm* and *the region*.

In 1990, ***Porter*** argued that the dynamic firm has become a globally decentralized enterprise-web of profit centers, business units, spin-offs, licensees, suppliers and distributors. While the region, as the optimal level of industrial, governmental and technological support, has become a *cluster* of large and small firms interacting with each other via subcontracting, joint venture, or other collaborative means, gaining external economies of scale in so doing. Due to the arguments of ***Amin*** & ***Thrift*** in 1992 and ***Grabher*** in 1993, the resurgence of regional economies has been often premised upon *'industrial districts'* of economic agglomeration networks of SMEs, embedded within the local milieu, based on coordination and innovation by enhancing international spillovers.

The Information Technology (IT) industry, as a *knowledge-intensive industry*, offers a good example of the contemporary regional and global relationship. The few large internationally dominating IT multinational enhance global convergence. But at the same time, local/regional forces differentiate IT production structures, levels of investment, Research and Development (R&D), and the learning and innovation processes in different localities/regions. Due to ***Storper***'s arguments in 1997, these differentiations lay in region-specific human relations, codes of practice and specialized knowledge.[16]

According to ***Tanes***, there are four research and development zones today and one by one they focus on different issues. The zones are summarized as follows:

[16] Vassilis Arapoglou, Theodosios B. Palaskas, Maria Tsampra, Innovativeness and Competitiveness of Regional Production Systems: Local and International Embeddedness of SMEs in the Information Technology industry, WP Rastei) 00-11, **"http://www.geog.ox.ac.uk/~jburke/wpapers/wpg00-11.pdf"**.

1st zone: In the very early days of humankind, R&D and innovation was an *art* and the people of talent innovated.
2nd zone: In the 1950's innovation was a *methodology* and planning issue.
3rd zone: Following the 2nd zone, in 1980's R&D shows up using the *customer oriented* method to innovate.
4th zone: The last zone is to be innovative with *all the employees.*[17]
In addition to all zones, it is claimed that we are in a new zone which can be interpreted as R&D and innovative activities themselves form the market now. At this point therefore it is necessary to identify the types of innovation.

1.3 TYPES OF INNOVATION

In today's world, innovation can be accomplished by various levels such as *firms, non-profit organizations, universities* and *states*. This thesis takes the innovation concept from the state's perspective, so innovations in other areas will be used to emphasize the role and effect of the states. No doubt a state cannot provide the detailed innovative solutions that firms and individuals do. However, it does provide the environment to encourage society to become innovative.

1.3.1 Product Innovation

In the first stage, innovations will be explained from a product basis. Product innovation is the first attempt to innovate management in companies as well as from the state's policy. Establishing *research and development centers,* techno-*parks, collaborating among integrated research projects* are all paths to make product innovations. In this respect, product innovations can be defined as new or better products (or product varieties) being produced and sold; it is a question of what is produced. The products may be brand new to the world, but they may also be new to a firm or country, diffused to these units.[18] Being new to customers, firm or within the market is the basic distinction of indicating the types of product innovations.

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[17] Yalçın Tanes, "Arçelik'te Teknoloji Geliştirme ve Ürün Geliştirme", **European Union 6th Framework Program and Industry Conference,** ISO, 2002.
[18] Charles Edquist, Leif Hommen, Maureen McKelvey, "Innovations and Employment in a Systems of Innovation Perspective", **Innovation Systems and European Integration (ISE)**, Sub-Project 3.1.2: Innovations, Growth and Employment, March 1998, p.15.

According to ***Schumpeter*** (1911), new products are the ones that the consumers are not familiar with.

In this sense, product innovation can be analyzed when product, process or service is clearly defined. Up to ***Assael***, "a product is defined as a *bundle of benefits* and *attributes* designed to satisfy consumer needs. The benefits of the product are those characteristics consumers see as potentially meeting their needs. When ***Apple*** introduced its first ***Newton*** handheld computer line in 1993, it took the industry by storm because it was the first to use a pen-like stylus to turn handwriting electronically into type. Apple had a choice. Did it view the Newton as an *extension* of its entrenched personal computer line, or did it view it as a *totally new product*? Because the Newton could be used anywhere for fax receiving, word processing, converting handwritten notes to type, and sending e-mail, Apple quite rightly decided to treat it as a new product innovation.[19] Another example of product innovation is the ***Hitachi's Microprocessor Wallet***, which was developed in 1996 to act as a *"Personal Digital Assistant"*. Humankind could communicate and access information for the first time with the help of this *Microprocessor Wallet* that they put in their pocket. When cellular phones were first introduced to the market, they were a great product innovation whose qualifications were being portable and wireless.

In addition, a product can be new to the company itself if there are no similar products in the production line of the company. Apple's Newton model computer was new to the company as well as to the customers because nobody had developed such a product before. It was for the first time that handwriting could be turned into type.

Accordingly, a classification should be made between being new to the customer, to the company or both. A product can be new to the customer when there are no similar products on the market. On the other hand, ***Nokia's*** 2002 model cellular phone is new to the company and customers, both because the rival cellular phones do not have the same qualifications like Nokia 2002 such as taking photo and e-

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[19] Henry Assael, **Marketing**, New York University, The Dayden Press, 1998, p.3.2.

mailing in only seconds. This innovation is new within the company as well as to the world. In this respect, product innovations can be grouped in the following below:

- **New Product Duplication:** New Product Duplication is a product that is known to the market but is new to the company.[20] For example: a Turkish company called ***Senur*** was manufacturing kitchen appliances. Almost ten years ago, they decided to expand their production range by adding *vacuum cleaners* which were already being produced in Turkey by national and multinational companies like ***Arçelik***. It is known that vacuum cleaners have been manufactured for many years and their technology is matured. In order to become competitive in the market, they developed the system further by increasing the *speed*, improving the *efficiency* and reducing the noise of the product.[21]

- **Product Extension:** A product extension is a product known to the company but *new to consumers*. The purpose is to allow the firm to present the consumer with a seemingly new product offering or improving from the existing products without requiring a costly new-product development process. There are three types of product extensions which are explained as follows:

- **Product Revision:** A product revision is an improvement in an existing product, for example, adding *fruit to yogurt* or *vitamins to cereals*. Additional ingredients were put into an already existing product, thereby creating a product revision. Besides that, ***Toshiba's*** high tech laptops are being revised at various times and periods. Every time Toshiba develops a new model, they innovate, which is why ***Toshiba****'s* ***Satellite*** model laptop has more than 10 versions with different properties.[22]

[20] Ibid., p.3.11.
[21] R. Nejat Tuncay, Temel Belek, Murat Yılmaz, Cünety Öncüloğlu, Gürol Kanca, "Yüksek Devir Hızlarında Çalışan, Sessiz , Hafif ve Üstün Kalitede Bir Elektrik Süpürgesi İçin Teknoloji Geliştirilmesi", **TTGV-041/D Project**, 1998.
[22] Assael, op.cit., p.3.2.

- **Product Addition:** According to ***Assael,*** a product addition represents an extension of an existing product line. For example: ***Arçelik's*** R&D Team which has conducted *extensive research* on permanent motor technology, have developed the first front loaded, direct-drive washing machine in the world. This technology is used in ***"Arbital"*** washing machines, which is a high end product and is advertised as one of the *most silent washing machine* in the world. In addition, ***Procter & Gamble*** retooled its corporate culture in the mid-1990s. In a three-year period during this time, it came out with 240 reformulations, from ***Secret Ultra Day*** antiperspirants to Sensitivity Production Crest toothpaste.

- **Product Repositioning:** Product repositioning is communicating a new feature of a brand without necessarily changing its physical characteristics. The *antacid Tums* was tied with *Rolaids* as a category leader until 1990, when ***SmithKline & Beecham*** repositioned the brand as a product that would fight *calcium deficiencies* in women. Their ***"Calcitums"*** advertising campaign allowed *Tums* to surge ahead with a repositioning strategy that required no product change. By 1994, women interested in supplementing their diets helped *Tums* win 21 percent of drugstore sales in the category-twice that of *Rolaids*. Tums was now firmly established to appeal to health-oriented women. As a result, in 1996 ***SmithKline*** introduced a line extension of *sugar-free Tums* products to go along with the calcium benefit.[23]

1.3.2 Process Innovations

As has been mentioned above, innovation can be applied not only to products but also at the process level. In this respect, process innovations are new ways of producing goods and services; it is matter of how existing products are produced. ***Schumpeter's*** original definition referred to a *"method of production"* or *"way of handling a commodity that is not yet tested by experience in the branch of manufacture concerned"*.[24]

[23] Ibid., p.3.11.

A process innovation depicts the introduction of any new element and/or advance in the physical production, service operations, or technologies related to the central activities of the industry. The innovations range from *minor (incremental)* to *major (radical)* changes in the manner goods are produced or tasks are performed within the industry. Process innovations may include process support, computerization, information processing, integration of communication and control processes, and new or improved automotive or manufacturing capabilities. For example: identified process innovations in the retail banking industry include profitability analysis by customer, centralized loan application processing, integrated *database management systems*, *image processing*, and *computer software assistance*.[25]

Organizations which frequently adopt process innovations are viewed as process oriented.[26] The operations of process oriented organizations are often more standardized, simplified, tightly controlled, and centrally planned. The organizations are interested in achieving a combination of *quality*, *low cost*, and *efficiency*. Decisions to adopt process innovations are commonly assumed to originate in the technical core areas of organizations.[27] In contrast to product innovation, process innovation is *intangible*. Thus, process innovations can be divided into two forms: technological and organizational.

- **Technological Process Innovations:** In technological process innovations, new goods are used in the *process of production*. They may have previously been material product innovations in an earlier stage of development. In other words, these goods appear in two incarnations in the economic system. An *industrial robot* is a product innovation when produced by ***ABB***. The robot is a technological, and at the same time process innovation, when used by ***Volvo***. [28]

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[24] Edquist, op.cit., p.17.
[25] Lisa S. Sciulli, **Innovations in the Retail Banking Industry: The Impact of Organizational Structure and Environment on the Adoption Process**, Garland Publishing Inc., New York, 1998, p.8.
[26] Micheal Treacy, Frederick D. Wiersema, **The Discipline of Market Leaders**, NY: Addison-Wesley Inc., New York, 1995, p.25.
[27] Roger Schemener, “How Can Service Businesses Survive and Prosper”, **Sloan Management Review Spring**, p.21-32.
[28] Edquist, op.cit., p.17.

- **Organizational Process Innovations:** Organizational process innovations are more productive ways to *organize work*; a new organizational form is introduced. [29] The Human Resources Department of ***Garanti Bank*** is going to redefine the job descriptions at all the levels of the staff. This project is an organizational process using innovation to restructure the bank's operations.

1.3.3 Technical Innovations

According to ***Daft*** (1978), technical innovation is one of the basic types of innovations.[30] They include new products and services, new elements in the processes or operations producing the new elements. They are the principal activities of the institution. For example: ***Arçelik's*** new technical innovation called *"Direct Drive"* is being used in all the home appliances of the company.

1.3.4 Administrative Innovations

In contrast to technical innovations, administrative innovations are tools between people to *achieve tasks*, *goals*, *structures*, *roles* and *procedures* that are related to the communication and exchange between people, and between the environment and people. [31]

1.3.5 Organizational Innovations

Innovations can be organizational that are taken into account as intangibles. As such they are also nonmaterial. They are never goods but they might be services in such cases- such as, for example, service products sold by organization consultants.[32] In 1966 ***Evan*** argued that the concept of *'organizational lag'* utilizes the distinction, positing that administrative innovation tends to 'lag behind' technical. Evidence supporting this, and showing its negative consequences for organizational performance, has emerged (***Damanpour*** and ***Evan***, 1984). ***Zaltman*** (1973) offer a

[29] Ibid.
[30] Richard L. Daft, "A Dual-core Model of Organizational Innovation", **Academy of Management Journal,** 21, 2 June 1978, p.193-210.
[31] Fariborz Damanpour, William M. Evan, "Organizational Innovation and Performance: The Problem of Organizational Lag", **Administrative Science Quarterly**, Vol. 29, 1984, p.394.

useful three-dimensional typology of innovations, also suggesting likely combinations of types though work exists on individual types from it, it has not been studied empirically as a whole.[33]

1.3.6 Radical Innovations

Radical Innovation occurs if the technological knowledge required to exploit it is very different from existing knowledge, rendering existing knowledge obsolete. Such innovations are said to be *competence destroying*.[34] *Refrigerator* was a radical innovation because making it required firms to integrate a knowledge of thermodynamics, coolants, and electric motors, which was very different from knowledge of harvesting and hauling ice.

1.3.7 Incremental Innovations

In incremental innovation, the knowledge required to offer a product builds on existing knowledge. According to ***Tushman*** and ***Anderson***'s arguments, incremental innovation is competence enhancing. For example: Making *Intel*'s Pentium chip run at 200MHz is an incremental innovation in the organizational sense, since the knowledge required to do so builds on the firm's knowledge in microprocessor development. According to ***Afuah***, most innovations are incremental.[35]

Besides the above arguments, innovation is described by many authors. For example: In 1968 ***Carlson*** argued that one of the innovation types should be *educational*. Besides, ***Kimberly*** in 1981 talked about *managerial* innovation. After five years, ***Ackermann*** and ***Harrop*** created a type of innovation which is called *corporate* innovation.[36] These type innovations were clarified at the time they were defined but they are not being used as terminologies today.

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[32] Edquist, op.cit., p.19.
[33] West, op.cit., p.49.
[34] Jennifer F. Reinganum, **The Timing of Innovation: Research, Development, and Diffusion in Handbook of Industrial Organization**, Volume I, R. Schmalensee and Wiling (eds.), Elservier Science Publishers, Amsterdam, 1989.
[35] Allan Afuah, **Innovation Management: Strategies, Implementation, and Profits**, Oxford University Press, New York, 1998, p. 15.

1.4 TRANSCENDING LEVELS AND FUNCTIONAL AREAS

According to ***Kuczmarski***, an innovation is an attitude that should be adopted throughout an organization by virtually every employee, from the top level manager to hourly workers. It is a *pervasive spirit* that stimulates individuals, as well as teams, to holistically endorse a belief in creating newness across all dimensions of the company. In the following transcending levels and functional areas of innovation are shown: [37]

- New markets
- New businesses
- New product ideas and services
- New manufacturing approaches
- New customer segments
- New selling methods
- New strategic directions
- New ways to deliver old products
- New leadership constructs
- New research techniques
- New thinking
- New adaptations
- New improvements to existing products
- New pay on performance compensation systems
- New ways to measure innovation

1.5 CIRCUMSTANTIAL SOURCES OF INNOVATION

According to ***Afuah***, there are three circumstantial sources of innovation which will be illustrated as follows: [38]

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[36] West, op.cit., p.9.
[37] Thomas Kuczmarski, **Innovation: Leadership Strategies for The Competitive Edge**, American Marketing Association, NTC Publishing Group, Chicago, 1995, p.11.
[38] Afuah, op.cit., p. 75.

1.5.1 Planned Firm Activities

Some innovations come from planned firm activities. This is what many people think about when they think about innovation. A manufacturer invests in R&D and other activities, and out of these investments come new ideas that are nurtured into new products. A customer, in the normal course of using a product, adds something to the product to make it easier to use. A complementary innovator adds some features to the main product to facilitate the use of its complementary products. Universities and government laboratories, in their normal course of research, *hit a breakthrough* that firms can build on to offer new products. In a way this is what we saw in exploring the functional sources of innovation.[39]

1.5.2 Unexpected Occurrences

During the planned activities, unexpected occurrences can be good sources of innovation.[40] For example: when *minoxdil* was tested for efficacy in treating high blood pressure, *Upjohn*, the developer of the drug, did not expect one of the side effects to be hair growth. The firm took advantage of this unexpected occurrence and now markets *minoxdil* as *Rogaine* to treat baldness. ***IBM*** developed the first modern accounting machine earmarked for banks in the 1930s. But banks then did not buy new equipment. IBM turned to ***The New York Public Library***, which then had more money than banks to spend on equipment.[41]

1.5.3 Change (Creative Destruction)

Schumpeter explained that processes intrinsic to any capitalist society engendered a *'creative destruction'* whereby innovations destroy existing technologies and methods of production only to be assaulted themselves by imitative rival products with newer, more efficient configurations.[42] Technological discontinuities, regulation and deregulation, globalization, changing customer expectations, and

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[39] Ibid., p.74.
[40] Peter Drucker, "The Discipline of Innovation", **Harvard Business Review**, Harvard Business School Press, Cambridge, 1991.
[41] Afuah, op.cit., p. 75.

macroeconomic, social, or demographic changes are also sources of innovation. Biotechnology, the web, fiber optic, digital movies, cable modems, massively parallel processors, and electric cars are all technological discontinuities of some sort as they offer an order of magnitude performance advantage over previous technologies. They also result in some sort of capabilities obsolescence. Such changes, referred to as creative destruction, occur where the old technological order is destroyed by technological innovation.

For example: Deregulation in telecommunications is allowing *cable companies*, regional phone companies, computer companies, long-distance phone companies, and even utility companies to vie for the delivery of voice, text, and images to customers. Deregulation and privatization are also taking place in Europe. Customers demand and expect certain levels of quality and price versus performance in the product that they buy. For various reasons, firms are no longer limiting their activities to their country of origin. Social or demographic changes, such as the changes from planned economies to capitalist ones, are also discontinuities, or baby boomers in the United States looking for luxury goods or ways of managing their own investment. These are all sources of new ideas to profit from. In this respect, creative destruction can be subtitled as follows:

- **Simultaneous Engineering**: It aims to *shorten product development times* by concurrently implementing steps in the product innovation process that are usually pursued consecutively. Most of establishments in the investment goods industry use simultaneous engineering.

- **Interdepartmental Development Teams**: They overlay or supercede functional intra-departmental project groups with cross-cutting teams comprised of staff from different units within a company, aimed again at accelerating ad improving the product innovation process.

- **Cooperation:** Cooperation in research and development with suppliers or

[42] Lee W. Mcknight, Paul M. Vaaler, Raul L. Katz, **Creative Destruction: Business Survival Strategies in the Global Internet Economy**, The MIT Press, Cambridge, 2001, p.4.

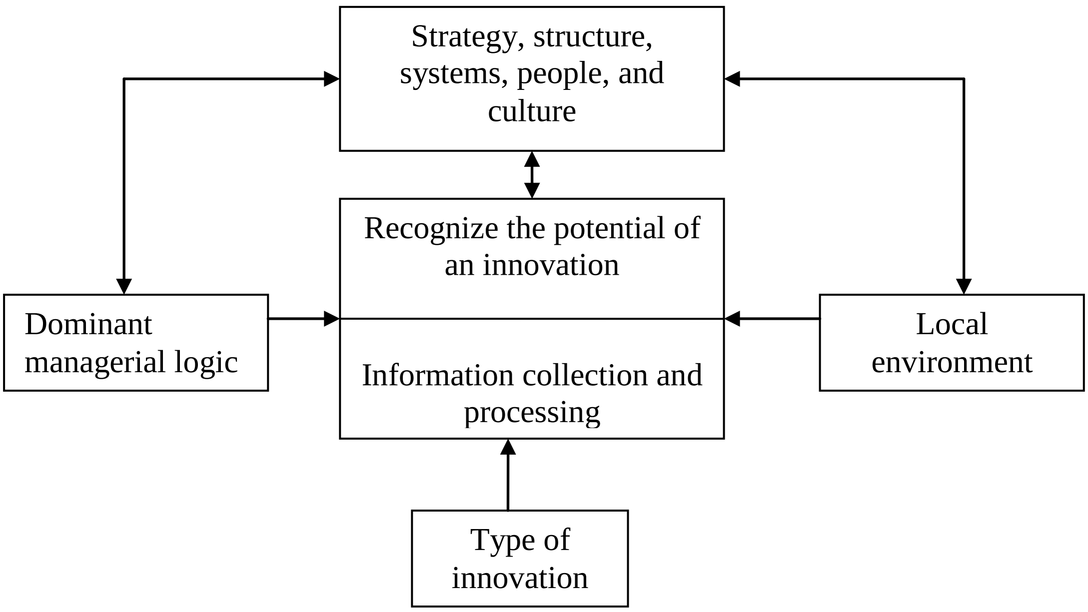
customers exists so as to better tailor product innovations, customer needs, and to fully exploit supplier capacities. This is the most widely diffused of the four new production concepts.

- **Continuous Improvement Process (CIP):** CIP is the way through which company personnel, not only from design departments but also from manufacturing, work together to overcome bottlenecks and enhance the product development process. [43]

1.6 RECOGNIZING THE POTENTIAL OF INNOVATION

A firm's ability to recognize the potential of an innovation rests on the way it collects and processes information and is a function of four factors. The first factor is the strategies, organizational structure, systems and people. The second one is its local environment, the third is its dominant managerial logic, and the fourth factor is the type of information in question. In the following figure, factors that underpin a firm's ability to recognize the potential of an innovation are presented:

Figure 1.1 Potential Factors of Innovation



Source: Allan Afuah, **Innovation Management Strategies: Implementation and Profits**, Oxford University Press, New York, 1998, p. 93

1.7 OPPORTUNITIES OF INNOVATION

Companies that emphasize innovations put more of their resources into *research and development* and *technical expertise*. Such firms are willing to take the risk of introducing new and untried products.[44] In this sense, an innovator is an *entrepreneur* and a *risk taker*, a company that prefers to concentrate on new technologies rather than focusing on the existing products markets. The aim is to reach new *customer segments* by innovation. In addition, from the marketers' point of view, there are many opportunities which are shown as follows:

- **Innovation as a New Industry:** When ***Netscape*** developed the web browser; there were no concepts like surfing in the internet, e-business, internet banking, and virtual search engines. This innovation opened the huge internet industry of today's world.

- **Innovation as Creating a Product Category:** ***Coca Cola*** was first innovated as for medicinal purposes caramel colored syrup for patients who had stomach aches. Later on, this "medicinal" syrup becomes the most popular beverage brand name all over of the world. ***Coca Cola*** also created a new beverage of similarly same name which is called *"Coke"*.

- **Innovation to Become a Monopoly in the Market:** When ***Sony*** produced *flat screen* televisions for the first time, they lock in all the distribution channels so that other companies can not enter the market easily. They innovated in order to become a monopoly, in other words, to be a leader in the market.

According to ***Assael***, "successful innovators generally reap enormous profits and market share. This is the company's return for investing heavily in R&D and marketing. The innovator has incurred these costs because it feels it can sustain a leadership position long enough to recoup them."[45] When companies were being

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[43] Afuah, op.cit., p.75.
[44] Assael, op.cit., p.3.11.
[45] Ibid., p.3.12.

analyzed, the ones that emphasize innovations are generally the *leaders* of their market. This is particularly true of Multinational Enterprises (MNEs) which can do more research and development than Small and Medium Sized Enterprises (SMEs). Furthermore, MNEs have the opportunity to allocate more resources to innovation, which is why they are *open to new systems, approaches* and *technologies.*

1.8 RISKS OF INNOVATION

Companies that do not innovate generally focus on the existing products and services. Some of them choose to be a *follower* in contrast to an innovator. As has been mentioned in the previous section, innovation is a risk taking issue. Companies who develop their products and processes should allocate large amounts of money to R&D activities because new product development in order to be successful, take substantial resources.

According to Assael, the innovator cannot always guarantee a sustainable competitive advantage, especially if it introduces an innovation outside its core area of competencies. For example, ***Arçelik***, Turkey's well known durable good manufacturer may decide to enter the air condition/purifier market in which it has never been involved. There is no doubt that Arçelik is taking risks because there are many rival firms already in the market that they introducing their product to. However, Arçelik which has its own research and development center, in the organization chooses to be a *'Learning Organization'* but taking the risks at the same time.

Innovations can be risky even if the company is operating within its core area of competencies, especially if a larger rival improves on the product or creates a similar one and sells it through stronger distribution channels.[46] This happened to ***Stac Electronics***, a 37$ million company, when ***Microsoft***, the 4$ billion powerhouse, took notice of ***Stac's*** compression system designed to free up space on hard drives. Microsoft copied Stac's system and incorporated it into its ubiquitous MS-DOS operating software. The competitive response nearly sent Stac into bankruptcy, but

[46] Ibid.

Stac sued Microsoft and won a jury verdict. When Microsoft threatened to appeal, a settlement was worked out, and Microsoft agreed to buy Stac for $83 million in 1994.[47] In 1996, a similar situation took place between ***Netscape*** and ***Microsoft***. Recent market indications show that even though Netscape tried aggressively to defend its nearly 80 percent share of the browser market[48], its share has now dropped to below 10%. This is a typical example of the risk of innovation.

According to ***Kotler***, a high-level executive can push a favorite idea through in spite of negative market research findings. The idea may be good but the market size can be overestimated so a new product may fail. In addition, the product may not be well designed. The product or process could also incorrectly positioned in the market, not advertised effectively, or overpriced. The product can fail to gain sufficient distribution coverage or support. Development Costs can be higher than expected or competitors fight back harder than expected.

There are therefore some factors that tend to hinder new product development. These are presented in the following:

- **Shortage of Important Ideas in Certain Areas**: There may be few ways left to improve some *basic* products (such as steel, detergents).
- **Fragmented Markets**: Companies have to aim their new products at smaller *market segments*, and this can mean lower sales and profits for each product.
- **Social and Governmental Constraints**: New products have to *satisfy* consumer safety and environmental concerns.
- **Cost of Development**: A company typically has to generate many ideas to find just one worthy of development, and often faces *high R&D, manufacturing*, and *marketing costs*.
- **Capital Shortages**: Some companies with ideas can not raise the funds needed to do research and launch a product.
- **Faster Required Development Time:** Companies must learn how to compress development time by using *new techniques*, *strategic partners*, *early concept tests*, and *advanced marketing planning*. Alert companies use

[47] Ibid.

concurrent new-product development, in which cross-functional teams collaborate to push new products through development to market. The ***Allen-Bradley Corporation*** (a maker of industrial controls) was able to develop a new electrical control device in just two years, as opposed to six years under its old system.

- **Shorter Product Life Cycles**: When a new product is successful, rivals are quick to *copy* it. Sony used to enjoy a three year lead on its new products. Now ***Matsushita*** will copy the product within six months, leaving hardly enough time for ***Sony*** to recoup its investment. [49]

As is seen, being innovative carries both opportunities and risks. The important situation is to analyze the current situation and act accordingly.

1.9 PRINCIPLES OF NEW PRODUCTION CONCEPTS

What is involved in the idea of *"new production concepts?"* The essential point is that the restoration and enhancement of industrial competitiveness in today's business environment calls for strategic, managerial, organizational and technical *changes* in the way manufacturing enterprises operate. Although analysts may differ on specific details, a basic consensus has emerged on the key principals that are involved.

Enterprises must meet the increasingly complex requirement of the market by simplifying their *strategic* and *operational planning* and *management systems*. This principle of simplification involves reducing the complexity of the product (by concentrating on its usefulness to the customer), of production (by concentrating on high performance process steps with a high value added). When attempting to control their internal complexity, enterprises need to rethink their hierarchical structures and decentralize their decision-making processes. Achieving this often requires a shift of *competencies*, through autonomous responsibility and self-organization, to decentralized organizational units.

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[48] Ibid.
[49] Philip Kotler, **Marketing Management**, Prentice Hall, Eleventh Edition, New Jersey, 2003, p.351.

External and internal *customer orientation* must be explicitly included in the strategy of the firm: close contact with external customers is regarded as the most important sensor for success in relevant markets. Moreover, within the enterprise, successive organizational units along the *process chains* should be regarded as internal customers. This requires the integration of plans as well as functions, thus enabling modifications in a firm’s performance to be directly linked to external and internal market signals.

The principle of concentrating on value added implies that inefficiencies should be avoided by confining the firm’s activities to specific *core activities*. In order to do so, the scope of the enterprise’s performance has to be optimized. Therefore, growing importance is given to the quality of the contacts with associated partners.

In every part of the enterprises, consideration must be given to communication and transparency as a *principle of openness* in the flow and exchange of information. This includes intensive communication with customers in order to be able to identify their current requirement, and also internal communication which aims at establishing short feedback and management loops within the decentralized units. In addition to openness about current actual performance, transparency about future business plans is very important in enabling decentralized management.

The firm must support the ability, desire, and willingness of its personnel to work. Thus, people as the main resource of an enterprise is now a focal point, with employees regarded as primary contributors to improved performance rather than simply as a cost factor.

The demand for greater flexibility and rapid customer response necessitates an integrated view of the product and the product process. In concrete terms, this implies an *object-oriented formation of organizational units*, instead of the functional orientation that has thus far been common. Planning and development processes have to be shortened by introducing parallel steps so that faster and far-reaching innovations become possible. The social dimension involves bringing employees from various fields of work together in task oriented project teams.

Besides improvements through far-reaching innovations, improvement in small steps *(continuous improvement)* is a main principle of new production concepts. Thus, it is important to involve the skills and creativity of all employees on all levels. In this way, the enterprise can become a '*Learning Organization*' through constant feedback between suggested improvements and their effects on processes and procedures within the firm.[50]

1.10 POSITIVE IMPACT OF INNOVATION IN PRODUCTIVITY

In an industrial context, *productivity* is the efficiency with which enterprises are able to transform purchased inputs into finished components and products. While the use of modern machinery is an essential element in attaining high productivity rates, in a global business environment where machinery is ubiquitous, further improvements in productivity are increasingly associated with *"working smarter"*, for example, through *enhancements in organizational structures*, *design for manufacturing*, *work processes*, *training* and *teamwork*.

In situations where manufacturers have adopted several complementary elements of new production concepts at the same time, the productivity effects are even greater. [51] According to the analysis of ***Lay***, the usages of new production concepts are *teamwork*, *integration of* responsibilities, *decentralization, manufacturing*, *just in time (JIT) from supplier*, *segmentation, Kanban systems, ISO 9000 Certification and quality circles.* They argued that new production concepts are one of the major reasons why users of these concepts have higher productivity levels than nonusers.

According to ***Lay***, follow-up qualitative surveys show when fundamental restructuring took place within a company, the great majority of these cases was triggered by productivity crises.

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[50] Gunter Lay, Philip Shapira, Jürgen Wengel, "Innovation in Production, The Adoption and Impacts of New Manufacturing Concepts in German Industry", **Series of the Fraunhofer Institute for Systems and Innovation Research (ISI)**, Germany, Physica –Verlag Heidelberg, Gunter Lay Edition, 1999, p. 20-22.
[51] Ibid., p. 34-36.

1.11 INFLUENCES OF NEW PRODUCTION CONCEPTS BY INDUSTRY AND EMPLOYMENT SIZE

According to ***Lay***[52] there is an impact of new product concepts as well as averages across all industries and employment size classes within the investment goods sector. But it is also apparent that there are major differences in productivity levels by *industry*, *employment size*, and the other factors within the *investment goods sector*.

The variations in performance by industry and size do influence the effects associated with the use of new production concepts. However, the extent of the improvement that can be made in productivity, quality and material buffers depend on the industry and its size. The examples of the arguments are summarized as follows:[53]

- **Teamwork:** The productivity effects achieved by introducing teamwork are strongest in large manufacturers (with a workforce of over 500). In small and medium sized manufacturers, the productivity potentials created through teamwork are definitely lower since here the unproductive elements of high task specialization (number of interfaces, unused capacities, doubling of tasks) are obvious not as strongly present as in large manufacturers. The introduction of *teamwork* thus has less potential for change.

- **Just-in time:** The inventory reduction effects achieved by *just-in time* supply were most significant in the automotive industry and in mechanical engineering. In these industries, the difference in the inventory stored by manufacturers employing just-in time supply and those that did not amounted to nine days of production. The differences in other sectors were not as noticeable.[54]

Within *large organizations* innovation faces special problems. As size increases, there is a tendency towards greater depersonalization coupled with a decrease in

[52] Ibid., p. 38.
[53] Ibid.
[54] Ibid.

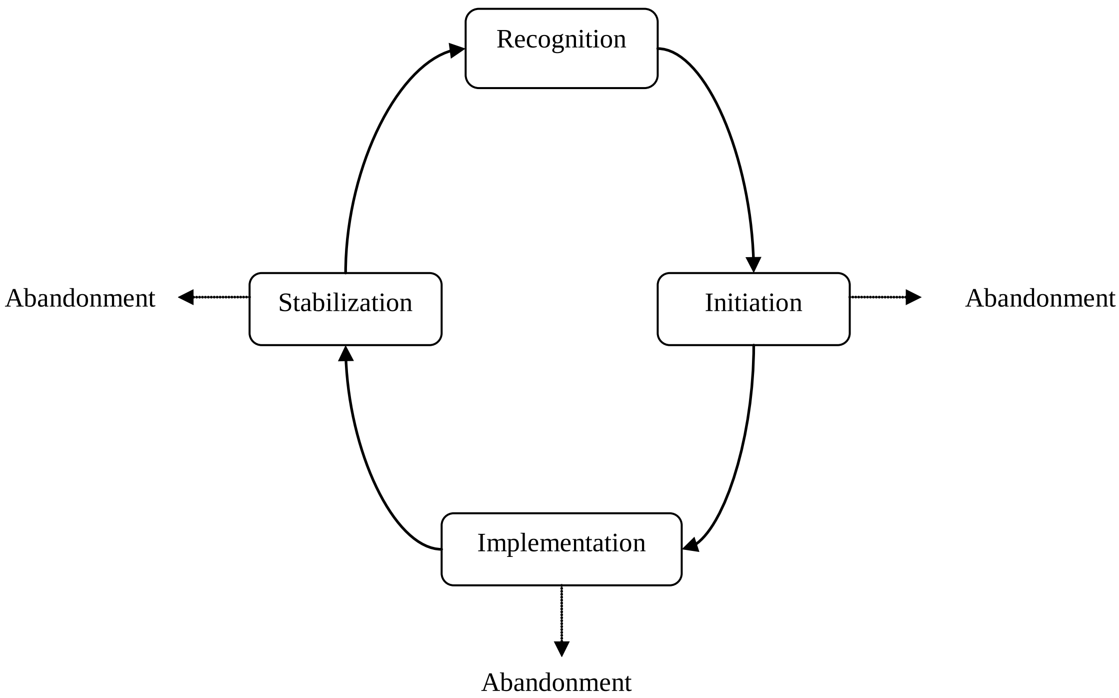
lateral and vertical communication. Many employees feel like faceless numbers, their position in the structure clearly identified by job descriptions and departmental assignments. In an attempt to protect the growing organizational assets, procedures are put in place. Over time, the organization becomes more *rigid* and the culture more *uniform*. Such organizations recognize that within the dynamic world in which we all exist, innovation is essential. Yet, large organizations face a *dilemma*. They must allow for change while still maintaining a high degree of organizational integrity. In practice, this is extremely difficult to do.

PART II
BASICS OF INNOVATION PROCESS

2.1 THE INNOVATION PROCESS

Schroeder defined the innovation process as the temporal sequence of activities that occur in developing and implementing new ideas.[55] All innovations may be considered to be modifications of existing group or organizational systems whether they are *technological*, *administrative* or *mixed*. Even new systems are never entirely separate from existing systems but rather evolve out of them. The corollary of this assumption is that all systems are a product of and subject to innovation. The system, and aspects of the system, can therefore be seen as continually going through an innovation cycle illustrated as follows:

Figure 2.1 Innovation Cycle



Source: Michael A. West, James L. Farr, **Innovation and Creativity at Work Psychological and Organizational Strategies**, John Wiley & Sons Ltd., England, 1990, p.324.

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[55] Schroder, R., Van de Ven, A., Scudder, G. and Polley, D., "Observations Leading to A Process Model of Innovation", **Strategic Management Research Center**, Discussion Paper No: 48, University of Minnesota, 1986.

According to the above figure, the first phase of the innovation cycle is *recognition*. In this situation, a performance gap is recognized and ideation occurs in response. Given that innovation may be imported without prior identification of a performance gap, the value of an external innovation may be recognized, ideation in the absence of a performance gap or a stimulus problem may lead to the recognition of a potentially useful innovation.

The second phase in the process of *initiation* involves proposing the innovation to others in the work group or organization. This phase is considered to include adjustment and development of the idea in response to reactions from others in the group or organization, and at the extreme the adjustment might involve abandonment of the innovation.

The third phase, *implementation,* is when the innovation is first used by the group or organization and its effects are observable in work practices, processes, products or procedures. At this phase the innovation may again undergo development or adjustment as constraints and opportunities become apparent in the innovation process. Following implementation is *stabilization,* which is when the innovation becomes a routinized part of the system with associated standardization and control procedures. Again, failure to stabilize is likely to lead to abandonment of the innovation or to further recognition and modification of the innovation, thus beginning the cycle again. [56]

2.2 TYPES OF INNOVATION PROCESSES

There are three types of innovation processes which are being characterized at *individual*, *organizational* and *social* levels. In each level, the innovation process is being defined different according to the models and theories.

[56] West, op.cit., p.325.

2.2.1 Individual Level of Innovation Processes

This part of the thesis is mainly concerned about the individual and innovation. People have to act in an innovative manner in their own life, work and environment so that innovative societies may appear. In this respect, there are some basic models that will be presented in the following part.

- **Wallas' Model of Creative Thinking**: In the model of ***Wallas*** (1926), four stages of creative thinking are identified: *preparation*, *incubation*, *illumination* and *verification*.[57] In the preparation stage, the problem and goals are being clarified. In the next stage, the problem is incubated for a while. In the illumination stage, the main solution of the problem is illuminated, which is to say it is clearly seen and definable. Lastly, the problem is verified to an appropriate solution by using logical analysis.

- **Basadur's Model of Creative Problem Solving:** Besides Wallas' model, ***Basadur's*** model (1982) is a complete process of creative problem solving. The three stages in the model which are: *Problem finding, problem solving* and *solution implementation.*[58] This model is also a good example of the innovation process.

- **Amabile's Social Psychological Model of Creativity:** One year after Basadur, ***Amabile*** (1983) developed a creativity model using five stages which are *task presentation*, *presentation, idea generation, idea validation* and *outcome assessment*.[59] In task presentation, the task to be undertaken or to be solved is presented to the individual, either by another person *(external source)* or by the person him/herself *(internal source).* The individual is more likely to attempt to solve the problem creatively if intrinsic motivation is high, which in turn is generally more likely if the problem is from an 'internal source'.

[57] Graham Wallas, **The Art of Thought**, London, Cape, 1926, p.79-96.
[58] Min Basadur, George B. Graen, Stephen G. Green, "Training in Creative Problem Solving: Effects on Ideation and Problem Finding and Solving in an Industrial Research Organization", **Organizational Behavior and Human Performance**, 30, 1982, p. 41-70.
[59] Teresa M. Amabile, **The Social Psychology of Creativity**, Springer Verlag, New York, 1983.

In the second stage *(preparation)* the individual builds up or reactivates a store of information relevant to the problem or task. Skills in the task domain therefore play a major role. In the *idea generation* stage, the individual produces possible responses in the research for solutions or ideas appropriate to the task in hand. The individual's skills in creative thinking will determine both the *quality* and *quantity* of ideas generated. In the fourth step of ***Amabile***, each idea generated at stage three is checked for its appropriateness or correctness for the task at hand by reference to the knowledge and assessment criteria included within domain-relevant skills. In the last stage, as a result of the check against task criteria carried out in stage four, a decision is made about the *potential task solution*.[60]

- **Rogers' Model of the Innovation Decision Process:** According to the ***Rogers'*** model, there are five stages in the innovation decision process: *knowledge, persuasion, decision, implementation* and *confirmation*.[61] The model is mostly concerned with the diffusion of policies such as birth control in the third world, or technological products such as drugs or agricultural chemicals. However, it could be readily modified to apply to individual innovation at work, especially in its emphasis on inter-personal communications. As with the other three models discussed here, ***Roger*** is more concerned with mental events than actions in a social context. Factors outside the individual do appear though: *'norms of the social system'* and *'social-economic characteristics'* of the individual are included as influences on his or her propensity to obtain *'implementation that involves overt behavioral change'*. One serious limitation of the model as it stands is that it is not applicable to cases where an individual invents an innovation rather than adopts one from outside.[62]

As has been mentioned in the above models, "the idea of innovation" or in other words "being innovative" is a *human originated* issue. Humankind is the basic

[60] King Nigel, **Innovation at Work: The Research Literature**, University of Manchester, UK, p.24-25.
[61] Everett M. Rogers, **Diffusion of Innovations**, 3rd edition, Free Press, New York, 1983.
[62] West, op.cit., p.24.

element to see and recognize the need for change and develop a new skill, system, product, process, idea, organization, etc. It is absolutely certain that people need *change* in their lives more than institutions and society. In this respect, the main idea here is that innovation can be achieved individually. First of all, people should be innovative in their own personal life and then they can create innovativeness for the society and the whole world. The needs of innovation for individuals are presented as follows:

- **Changing the Existing Situation:** Generally people have difficulty evaluating the current situation and, if it is not being evaluated well, the need for change can not be recognized. People can not aware of the strengths and weaknesses when they are themselves involved in it. Individually, if a person has the capability to change the existing situation, this shows the positive impact on *change* and *innovativeness* on the other issues.

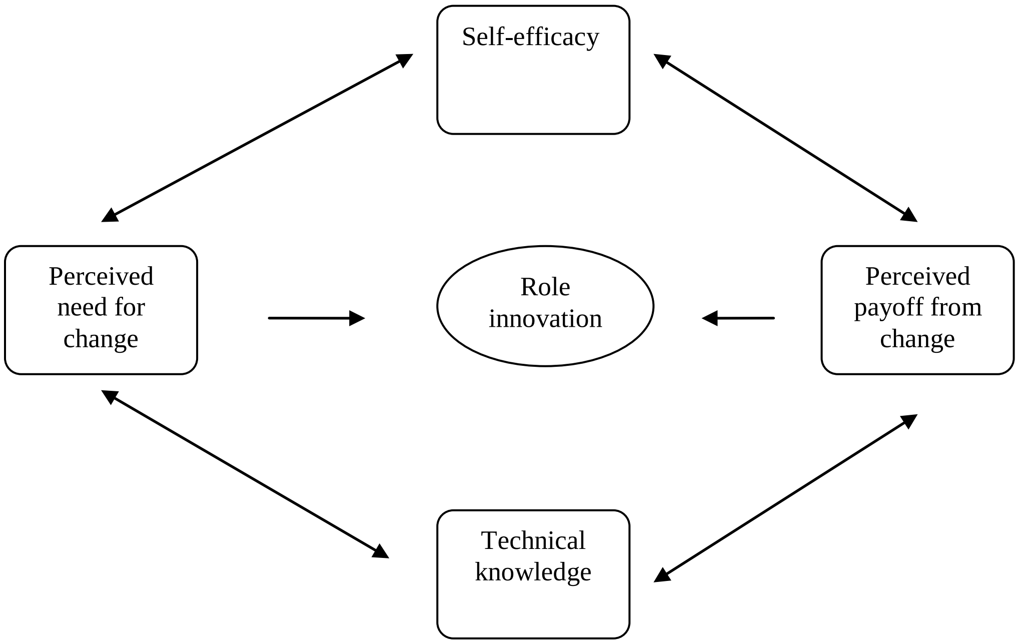
- **Open to Newness:** Individuals should be open to new things in their own personal lives so that their *natural tendency* of innovation increases. Being open to change is a very important matter to increase the innovation of the society also.

- **Problem Solving Abilities:** Most of the times innovation or creation takes place in the heart of the problem solving periods. Humankind should face a *difficulty* in the natural order of things in order to change the current situation or develop the condition.

- **Entrepreneurial Skills:** An individual has the opportunity to plan his/her future by forming a personal vision and the strategies. In general, people organize their behaviors and attitudes according to the *current situation*, *chances*, *possibilities* and *opportunities*. A good decision on those personal issues such as choosing the right career will insure success.

Besides the above, the following figure of a model of individual motivation will be shown to present the likelihood of an individual introducing an innovation.

Figure 2.2 Model of Individual Motivation



Source: Micheal A. West, James L. Farr, **Innovation and Creativity at Work Psychological and Organizational Strategies**, England, John Wiley & Sons Ltd., 1990, p.65

In the above figure, the likelihood of an individual introducing an innovation in the work role is a function of four general factors. These factors are:

- The individual's perception about the *need for change* to occur in the work role.
- The individual's perception that change can be successfully implemented in the work role, that is, ones belief in efficacy concerning the implementation of change.
- The individual's perception that a positive outcome will result from the introduction of change.
- The individual's ability to *generate new* and *useful ideas*.[63]

[63] West, op.cit., p.65.

2.2.2 Organizational Level of Innovation Processes

The member characteristics of a organizations innovativeness are *leaders, decision-makers, idea champions* and *change agents*. In 1969, ***Mohr*** found a significant relationship between leader motivation, conceptualized in terms of ideology-activism and frequency of innovation.[64] In the organizational level of innovation, ***Ven*** proposed three principles for developing an infrastructure that is conductive to innovation and organizational learning. First, critical limits for organizational innovation must be defined with a clear set of values and standards. Second, the organization needs to develop the capacity for double-loop learning, it must be able not only to detect and correct errors in the standards themselves. Third, the organization must preserve rather than reduce uncertainty and diversity. ***Patti's*** 1974 work addresses the issue of how *decision-makers react* to innovations proposed by subordinates.

In studies carried out by ***Bouwen*** and ***Fry*** in 1988 and their colleagues, it was commonly observed that innovation required the extraordinary effort of an individual idea champion, and they argue that: *'Part of managing novelty is therefore concerned with how the enterprise allows and rewards such courageous persons to emerge and attract other's attention*. ***Bouwen*** and ***Fry*** are chiefly concerned with individuals who informally adopt the *'idea champion'* role, but often an individual (frequently an outsider) is formally appointed to the task of overseeing the innovation process. Such an individual is commonly called a *'change agent'*, and there exists a large body of research concerning the appropriate actions and characteristics of change agents. [65]

Besides the need for individual actions, some organizational and social improvements can be accomplished by creation and innovation. In the following section, some methods for more effective usage of business and public institutions will be summarized.

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[64] Ibid., p.28.
[65] Ibid., p.29.

- **Solving the Organizational Problems:** In the types of innovation process definitions offered problem solving abilities has been mentioned at the individual level of innovation processes. But if a company meets an organizational problem, this gives *higher responsibility* than the personal problems. However, towards problem solving is the same at both the personal and institutional levels. It is up our *innovativeness* and *creativity*.

- **Change the Existing Processes and Systems:** Every institution and organization has its own laws and regulations. Any change in the existing process and system occur only if these regulations are considered. At first, it is important to *recognize the need* of newness.

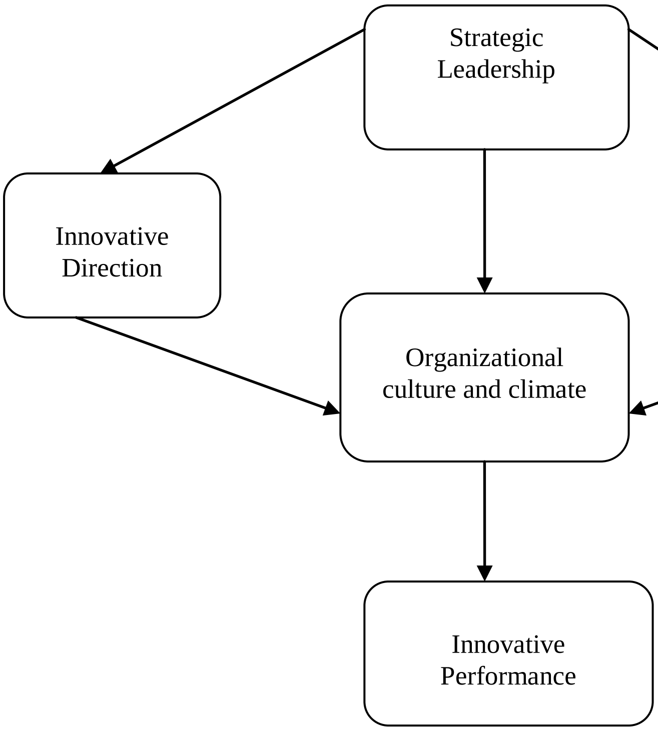
- **Creating New Fields of Studies or Investment:** Following a change of the process/product or system, a *new field of study* should be developed in place of the old one. If institutions are open to changes, this would affect both the staff and the company positively. The term *"Learning Organization"* contains the creation of new fields of studies in which organizations learn and change continuously.

- **To Improve Institutional Vision and Strategies***:* Institutions should have a *vision*, a *mission statement*, *strategies* and *development plans* (per year). All of these prepare the institution and make it ready for new developments, as well for the influences of people in the organization. These plans should be flexible to cover new developments.

- **To Design a System, Product or Process and Technology:** It does not matter where or when innovation takes place: being creative is both an *individual talent* and *a performance* of collaborative and well-educated team work. To design a system, process and technology, or develop a new product is a very important task of the organizations if they are to compete with the other firms, brands and etc.

The following, basic model of organizational innovation is presented to illustrate the relationship between innovative potential, direction, strategic leadership, organizational culture and innovative performance.

Figure 2.3 Basic Model of Organizational Innovation



Source: Michael A. West, James L. Farr, **Innovation and Creativity at Work Psychological and Organizational Strategies**, England, John Wiley & Sons Ltd., 1990, p. 145

The first strategic variable in the above figure is innovative direction, for example, what radical changes the company wants to achieve. The second is innovative potential, what the company can do given its structural restraints, its prevailing material and immaterial resources. In this framework strategic leadership can influence both what the company wants to do and what it can do. By focusing on specific new technologies and markets, the company can change its innovative direction, and by generating better resources the company can improve its innovative potential, for example, *its possibilities for successful innovation*. [66]

[66] Ibid., p.144.

2.2.3 SOCIAL LEVEL OF INNOVATION PROCESSES

In addition to individual and organizational innovativeness, the importance of sociological and state policies can not be underestimated.

- **Determining State Policy and Strategies:** Besides individual and institutional innovation, a society also can have an *innovative structure*. The first step is to determine state policies and strategies. Innovative activities within the states can be increased by planning the innovation processes.

- **Utilizing the Resources or Creating New Resources:** If the resources are used more efficiently, the production and innovation increases.

- **Establishing New Job Opportunities:** In the innovation process, states which are successful in innovation do not have a problem of unemployment. New job opportunities should be increased.

2.3 SYSTEMS OF INNOVATION APPROACHES

A System of Innovation is an *environment* which includes all of the innovation tools, mechanisms and institutions. It gives rise to an evolutionary pattern of technical change in terms of individual and collective activities. ***Nelson*** in 1995 has argued that evolutionary theories have three major characteristics:

- Explanation is of *change* over time.
- Discussions include the renewal of variety and the systematic selection processes.
- There are some elements of continuity, or historical inertia.[67]

[67] Nelson Richard, "Economic Growth via the Co-Evolution of Technology and Institutions", L. Leydersdorff and P. van der Besselaar (eds), **Evolutionary Economics and Chaos Theory: New Directions in Technology Studies**, St. Martin's Press, New York.

In 1997 ***Nelson*** and ***Edquist*** analyzed the emergence of ***Systems of Innovation*** approaches and identified eight basic characteristics as follows:

- **Placing innovation and learning processes at the center of focus:** On the understanding that technological innovation is a matter of producing new knowledge or combining existing elements of knowledge in new ways hence, in the broadest sense, a *'learning process'*.[68]

While innovation is being analyzed, the existing elements of the knowledge should be combined as well as producing new knowledge. An increase in the emergence of learning organizations is the most important issue in the company, as well as the *state's policy*. In order to be innovative, the organization should have an *open policy,* which means the highest interaction possible with the market, rival firms and other states.

- **To adopt a holistic and interdisciplinary perspective:** Holistic in the sense that they have the ambition to encompass a wide array of or all of the determinants of innovation that are important, and interdisciplinary in the sense that they allow for the inclusion not only for economic factors but also of *organizational*, *social* and *political factors*. [69]

When we scrutinize innovation from interdisciplinary point of view, it should be analyzed not only economically; it should also be interpreted from organizational, social and political factors. The Systems of Innovation approach will be analyzed more thoroughly from state's point of view under the title of *"National Systems of Innovation"*.

- **To employ historical perspectives:** Since processes of innovation develop over time and involve the influence of many factors and feedback processes that are best studied in terms of co-evolution of knowledge, innovation, organizations, and institutions.[70]

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[68] Edquist, op.cit., p.8-9.
[69] Ibid.
[70] Ibid.

The historical background of innovative movements should be analyzed carefully in order to understand the effects of Systems of Innovation. This perhaps can explain why the same *innovative infrastructure* yields different results in different societies.

- **To stress the differences between systems, rather than the optimality of systems:** Making the differences between systems of innovation a main focus, rather than something to be abstracted away from. This means conducting *comparisons* between existing systems rather than between real ones and an ideal or 'optimal' one.[71]

It would be much more effective to compare existing innovation systems under the assumption that there is no ideal innovation system. So it is important to focus on actual systems rather than a hypothetical optimal one. If we think in terms of controversy, there should be *one or more* than one ideal systems of innovation. Innovation means to change and learn continuously. In this respect, the optimal system of innovation does not fall behind the changes occurring what every way, around it. The state may compare its innovativeness to other states or the ideal innovation system to increase the efficiency.

- **Emphasizing interdependence and non-linearity:** On the understanding that firms almost never innovate in *isolation*, but interact more or less closely with other organizations through complex relations that are often characterized by reciprocity and feedback mechanism in several loops. This interaction occurs in the context of institutions e.g., laws, rules, regulations, norms and cultural habits. Innovations are not only determined by the elements of the systems, but also by the relations between them.[72]

Being innovative is directly related with interaction and collaboration among other organizations. It is sure that innovation policy of the state designates and allows the capability of innovativeness. If a state supports innovation, this shows that the country is *open to changes* and *absorbs new developments easily* and

[71] Ibid.

quickly. In this respect, enterprises which are innovative should emphasize interdependence and non-linearity. They should be in contact if they want to innovate, and the ones that prefer to stay in their own borders without interacting will loose in the end.

- **To encompass product technologies and organizational innovations:** Created with an understanding of the importance of that developing a differentiated concept of innovation, for example, one which is not solely restricted to the conventional emphasis on process innovations of a *technical nature*.[73]

At first glance, innovation is defined as a new product that no one has ever made before. However, its definition is much wider than this. It emphasizes the product, process and organizational novelties in general. The new product development process is especially a basic point in innovation.

- **To emphasize the central role of institutions:** In order to understand the social patterning of innovative behavior, the central role of institutions is emphasised. It is typically *'path-dependent'* in character and the role played by institutions in the sense of norms, rules, laws, organizations, etc.[74]

Innovative behaviour is *dependent* and *independent* at the same time, so this makes innovative movements very complex. In order to be innovative, conditions should first of all be open to innovation, resources, to new product development or the expectations of the public. From the institutions perspective, they can look at innovation positively if and only they can see an *affirmative change* in their organization. So being innovative is dependent because there is always an institution related to the process, which may support or deny its support. The rules, norms and organizations are all very important when the decision is made whether to innovate or not. The institution's general structure shows the degree of innovativeness. In contrast, innovative behavior may be realized independent

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[72] Ibid.
[73] Ibid.
[74] Ibid.

of the institution because individuals are initiators of the innovation process. Each person is independent, which is innovative behavior can be inferred as being independent.

- **Innovation is a conceptual framework, rather than formal theories:** Recognizing that the approach is not yet at that stage of development where it is capable of 'formal' theorizing, intended to capture processes of innovation, their determinants, and some of their consequences in a meaningful way.[75]

Innovation is a conceptual definition, which implies continuous progress or developments. It would not be correct to define the borders of innovations explicitly; instead one has to be prepared to interpret it in a wider manner.

2.4 TYPES OF INNOVATION APPROACHES

2.4.1 Schumpeterian Approach

At first sight, ***Schumpeter*** argued that small entrepreneurial firms were the sources of most innovations.[76] According to Schumpeter, research and development activities can only occur if the organization is small or medium sized. In addition, innovation only takes place if an entrepreneurial idea is taken for development of the idea.

After presenting this view, Schumpeter contradicts his assumption by saying that large firms with some degree of monopoly power were more likely to be the sources of technological innovation. Large firms have the production and other complementary assets that are necessary to commercialize an invention; they have the size to exploit the economics of scale that are prevalent in R&D; they are more diversified and therefore more willingly to take the kind of risk that is inherent in R&D projects; have better access to capital than smaller firms and therefore are more likely to invest in them.[77]

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[75] Ibid.
[76] Joseph Schumpeter, **Capitalism, Socialism and Democracy**, 3. Edition, New York, Harper, 1950.
[77] Ibid.

Empirical studies in search of support for either position have not been able to establish a clear relationship between a firm's size, market power and its innovative activity.[78] By shifting the focus to the type of innovation, however some research suggest that whether incumbents or new entrants are able to introduce and exploit innovation is a function of whether the innovation is *incremental* or *radical*, that is, a function of how new knowledge and the new product are.[79]

In 1911, ***Schumpeter*** argued that innovations are new or improved products and processes, new organizational forms, the application of existing technology to new fields, the discovery of new resources, and the opening of new markets. In Schumpeter's view, these types of innovation arise mainly in large private firm, with a secondary role left to *small and medium-sized enterprises, government labs, universities*, and *state enterprises*. [80]

In addition, he defined *product innovation* as the introduction of a new good or a new quality of a good, and *process innovation* as the introduction of a new method of production or a new way of handling a commodity commercially (cited in Archibugi, Evangelista, and Simonetti 1994:7; Schumpeter 1911).

According to ***Schumpeter's*** theory, innovation is the key point in the capitalist system in order for companies to *survive*. He said that innovation only occurs if an existing product or the service is changed with a *new one*. As has been mentioned in the first part of the thesis, this situation called *creative destruction,* is one in which the norms and innovation are the main drivers of wealth. While innovations produce creative effect on companies in the uprising direction, it becomes destructive for others which could not cope with changing priorities, structures and products.

In today's rapidly changing economy, firms should change *continuously*. They have to develop new techniques in management and marketing, and produce innovative

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[78] Morton I. Kamien, and Nancy L. Schwartz, "Market Structure and Innovation: A Survey", **Journal of Economic Literature**, 1975.
[79] Michael L. Tushman, Philip Anderson, "Technological Discontinuities and Organizational Environments", **Administrative Science Quarterly**, 31, 1986, p.439-465.
[80] Jorge Niosi, Paolo Saviotti, Bertrand Bellon, Micheal Crow, "National Systems of Innovation: In Search of a Workable Concept", **Technology in Society**, Vol.15, Pergamon Press Ltd., 1993, p. 207-227.

products and services, etc. In order to achieve these objectives, these companies should adopt *correct* R&D policies. Those companies, which do not change, will loose in the end. *Multinational Enterprises (MNEs)* especially have an important role because they provide high working standards with qualified employees. MNEs have the opportunity to do more R&D than other firms. They are open to new technologies which increase the degree of competition. The companies may either trade (licensing, know-how, import, export) for them or form a new structure such as *Foreign Direct Investment (FDI)* when the need arises.

Schumpeterian views *(evolutionist)* became well known in 1982 when ***Nelson*** and ***Winter's*** evolutionist theory on technological innovations and learning processes was published. The evolutionist approach looks for the research and development processes of the new technologies and, it investigates the adaptation processes of the new technologies.

According to the evolutionist theory; *invention, innovation* and *diffusion* are three stages of a continuous and a very complex process. Evolutionary economics stresses the importance of accessing, developing and using knowledge and technology. Innovations and technical change are motors of economic change, in the sense that they create industrial and economic dynamics. Moreover, high-tech sectors involving product innovations have been identified as having high growth in productivity and employment.[81]

2.4.2 Neo-classical Approach

Taymaz states that, technology and innovation economy in the neo-classical approach makes it an extension of the neo-classical production economy.[82] Besides, ***Soyak*** argued that in a neo-classical economy, technology is a process of *inputs* and *outputs*.[83] The Neo-classical approach emphasizes in general, neutral policies in regards to technology and the innovation relationship. States should support

[81] Edquist, op.cit., p.131-152.
[82] Erol Taymaz, **Ulusal Yenilik Sistemi Türkiye ve İmalat Sanayiinde Teknolojik Değişim ve Yenilik Süreçleri**, TÜBİTAK, Ankara, 2001, p.6.
[83] Alkan Soyak, **Teknolojik Gelişme ve Özelleştirme: Telekomünikasyon Sektörü Üzerine Bir Deneme**, Kavram Yayınları, İstanbul, 1996, p.21.

technological and innovative organizations in the production process of technological innovations because in some way *market failure* may occur if it is not being supported.

According to ***Metcalfe*** a national systems of innovation is[84] "That set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies, and which provides the framework within which *governments* form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to *create*, *store* and *transfer the knowledge*, *skills* and *artifacts* which define new technologies".

Under this circumstance, being innovative is not an independent activity which individuals, firms, research institutes or universities make; the important point is how they *interact* with each other as elements of a *collectivist system* of knowledge creation and usage. Besides that, the above mentioned elements should also interplay with social institutions such as values, norms and legal frameworks.

2.4.3 Porter's Approach

Information plays a large role in the process of innovation-information that is not sought or available to competitors, or information available to competitors, or information available to others to be interpreted in new ways. According to ***Porter***, innovators are *outsiders* in some way to the existing industry. Innovation may come from a new company, whose founder has a non-traditional background or was simply not appreciated in an older, established company. Or the capacity for innovation may come into an existing company through senior managers who are new to the industry, and thus more able to perceive opportunities and are bolder in pursuing them. Or innovation may occur as a company diversifies bringing new resources, skills, or perspectives to another industry. On the other hand, innovations may come from another nation with different circumstances or ways of competing.

[84] Stan Metcalfe, "The Economic Foundations of Technology Policy: Equilibrium and Evolutionary Perspectives", in Paul Stoneman (ed.), **Handbook of the Economics of Innovation and Technological Change**, Blackwell, Oxford, UK, Cambridge, USA, 1995, p.409-512.

Porter argued that with few exceptions innovation is the result of an unusual effort. The firm that successfully implements new or improved ways of competing is the one that doggedly pursues its approach, often in the face of obstacles. [85]

Porter (2000) stated that the business environment is understood in terms of four interrelated influences that take part in the literature as *Porter's Diamond*: the quality of factor (input) conditions, the context for firm strategy and rivalry, the quality of demand conditions, and the presence of related and supporting industries. Successful economic development is a process of successive upgrading, in which the business environment in a nation evolves to support and encourage increasingly sophisticated and productive ways of competing.[86]

2.5 NATIONAL SYSTEMS OF INNOVATION

In 1988, the idea of national systems of innovation was coined by the Swedish economist ***Lundvall***. In addition, in 1987 **Freeman** wrote about the accent on social and political institutions that accompany technical innovations. According to ***Freeman***, national systems of innovation are *"the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify, and diffuse new technologies*. In addition to that, in 1993 ***Nelson*** explained National Systems of Innovation as: being at least in part a function of government policy at the national level; formal state regulation and informal coordination; R&D funding, and the resultant public stock of knowledge that would develop *homogeneity* and *linkages* among national agents of innovation.

Niosi, ***Saviotti***, ***Bellon*** and ***Crow*** stated that in the last 50 years the theory of industrial innovation has moved from a very single description of an entrepreneur and the isolated firm as *innovating units* to a more including set of elements. In other words, the development of innovation theory is one through which new elements of the firms' environment have been included in the theoretical system. The idea of a national system of innovation is the last step of this trend toward an increasingly

[85] Micheal E. Porter, **The Competitive Advantage of Nations**, Macmillan Business, London, 1998, p.48.

complex and encompassing concept. Most technological innovation takes place within *private* innovating firms and other institutions such as universities, government labs, state corporations *(like Airbus industry in Europe or Atomic Energy of Canada),* etc. Government agencies for coordination *(like MITI in Japan)* and financing *(like DARPA in the US)* also have a crucial role in the process of creating new technology. The links among the units in ***National Systems of Innovation*** are grouped as follows:

- **Financial flows:** They occur with *public* financing of innovation holding first place, but also including *private* financing of innovation and capital investment.
- **Legal and policy links:** They are named with *intellectual property rules,* technical standards, and technology and procurement policy, and applying basically to all national firms, thus bringing some degree of state coordination among units.
- **Technological, scientific, and informational flows:** They are market-driven, domestic, scientific and technical collaborations and interactions.
- **Social flows**: They are organizational innovations flowing from one firm to the other and personal flows; mainly from university to university, but also from firm to firm. [87]

According to the definition of ***Niosi***, ***Saviotti***, ***Bellon*** and ***Crow***, a National System of Innovation is the system of interacting private and public firms *(either large or small),* universities, and government agencies aiming at the production of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social, and financial, in as much as the goal of the interaction is the development, protection, financing, or regulation of new science and technology. In most national systems of innovation, most of the units are *corporations*. However, the *state* is the dominant element. This is so, firstly because it finances (and sometimes executes) a very important share of the national R&D.

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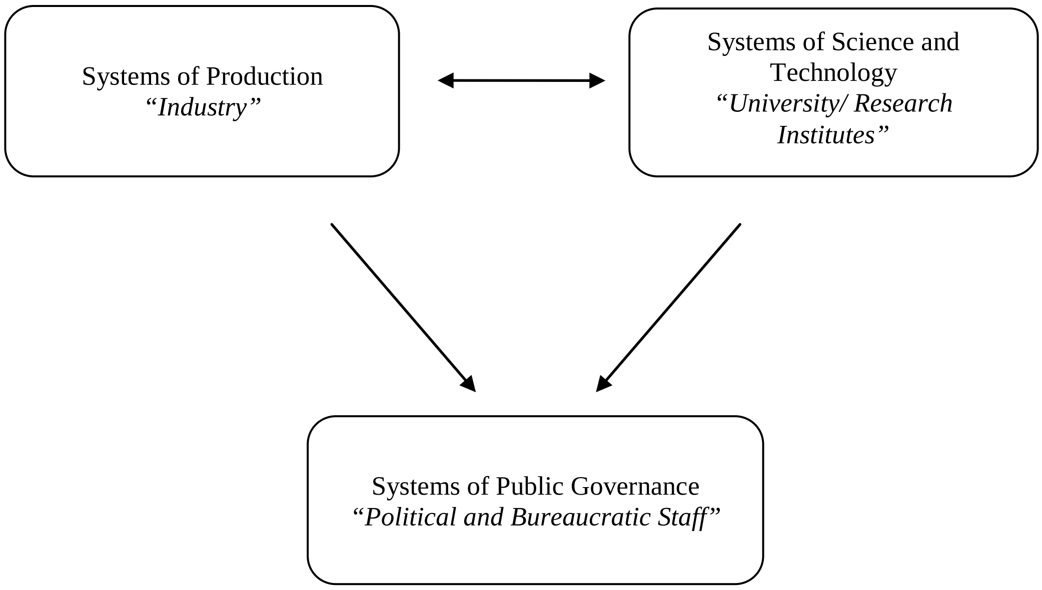
[86] Micheal E. Porter at al, "The Global Competitiveness Report 2000", **World Economic Forum**, New York, 2000.
[87] Jorge Niosi, Paolo Saviotti, Bertrand Bellon, Micheal Crow, "National Systems of Innovation: In Search of a Workable Concept", **Technology in Society**, Vol.15, Pergamon Press Ltd., 1993, p. 207-227.

- Specific urban or local districts where innovation takes place, *like Silicon Valley or Boston's Highway 128 in the U.S.*
- Specific industries with strong innovative strong innovative trust, such as *textiles and garments in Italy, telecommunications equipment in Canada, or agricultural business in France.*
- Automotive industry *in Germany, USA and Japan*.
- Specific sets of corporations with some innovative strategic behavior *like just-in-time or concurrent engineering adopters in Japan.*
- Mining, chemical and vehicle manufacturing clusters *in Turkey*.[88]

In the following figure, ***National Systems of Innovation*** is shown in order to prove the above mentioned theories and examples:

Figure 2.4 National Systems of Innovation



Source: Ercan Tezer, "Otomotiv Sanayii ve Yenilikçilik", **TÜBİTAK MAM**, Gebze, 2002.

[88] Sedef Akgüngör, "Innovativeness Within Industrial Relationships: A Case Study of Industry Clusters in Turkey", **Academy of Marketing Science**, Multicultural Conference Proceedings, Valencia, Spain, June 26-29 2002, ed. by Salah S. Hassan, Enrique Bigne, J. S. (Vic) Johar ISBN: 0-931268-24-9, SSN:0149-7421, p .730-746.

The above figure illustrates ***National Systems of Innovation*** theory in which there are three systems and three related ways of innovating. *The Systems of Public Governance* supports *Systems of Production* and *Science & Technology* as a whole. According to ***Tezer***, a successful innovation system occurs only in the "Political and Bureaucratic Staff" of Public Governance.

The basic components of National Systems of Innovation are:

- Innovative firms focusing on R&D
- Fundamental research by Public Institutions
- Technology Development Centers
- Techno-parks
- Pre-entry market strategic alliances
- University-industry collaboration centers
- R&D /education institutions
- National Information Infrastructure
- Financial Support Institutions
- Patent Institutions
- Standards and Quality Audit Institutions
- Project Markets
- Consultancy Firms

Learning economy theory by ***Lundvall*** & ***Johnson*** in 1992 interprets the changes in contemporary economic competitiveness, and explains its most advanced forms by focusing on networks and knowledge spillovers. Networking and learning capacity is the outcome of greater economic reflexivity; the firms, sectors, regions and nation which can learn faster or better become competitive because their knowledge is scarce, and therefore not easily imitated by, or transferred to competitors via codified and formal channels (Cooke et al 1991). The term *learning* refers specially to product-based technological learning, which is different from technology imitation in the production processes. It stresses the importance of technological change in product adaptability as the principal competition pattern.

According to ***Lundvall*** & ***Johnson*** in 1992, *learning* is the outcome of increased economic reflexivity: The *firms*, *sectors*, *regions* and *nations* which can learn faster or better become competitive because their knowledge is scarce, and therefore not easily imitated or transferred, via codified and formal channels, to competitors. The central emphasis of the *'learning economy'* concept is on time, in sustaining a desirable form of imperfect competition, characterized by ongoing product-based learning. It generates a temporary scarcity of key-inputs, especially labor and human relations. According to ***Storper*** in 1997, the term 'learning' refers specifically to imitation in product processes, and stresses the importance of technological change in a product's adaptability as the principle competition pattern.

According to ***Grabher***, innovation is attained through flexible networking among business units such as *professional capacity*, *support institutions*, and *market specialization*. Such networking is based on professional synergy, interactive learning, and hence, loose coupling among agents, which generate positive externalities in contemporary economic systems. These are increasingly based on the interaction of socio-economic interdependencies such as the spillovers of knowledge or ideas often embedded in relational communication processes.

Scott, ***Cooke***, ***Dunford***, and ***Komninos*** & ***Seferzi*** mentioned the key importance that has been recently assigned to innovation, technical change and technology externalities in shaping and transforming the space economy. Knowledge spillover effects and innovative growth have resulted into neo or reindustrialization processes, and the internationalization of local productive systems, redefining the word *'core'* and *'periphery'*. These considerations drove to identify the role of internal effort or external linkages in a firm's innovation *capacity*, the role of the local or international ties in a regional production system's innovativeness and competitiveness in the contemporary global economy.[89]

According to the analysis of ***Taymaz***, the National Systems of Innovation changes from one country to another. ***Taymaz*** shows that innovativeness of any state is

[89] Ibid., Arapoglou.

related to the economic growth of the country. In this respect, ***Taymaz*** compared Turkey's economical growth rate to some states (*U.S, Japan, Spain, Mexico, Korea*) and found out that *Turkey*'s performance is not lower than some states such as Spain, Mexico and Korea. [90]

2.6 THE EFFECTS OF ECONOMIC INFRASTRUCTURE ON INNOVATION SYSTEMS

When the effects of economic infrastructure on Innovation Systems are analyzed, two distinct infrastructure elements come out which show the importance of the infrastructure issue to innovation. The elements are summarized as follows:

- **Physical infrastructure:** Roads, harbors, electricity production and distribution systems, telecommunications networks, internet access mobile communication network, etc.
- **Knowledge infrastructure:** Universities, research labs, training systems, and organizations related to standardization, intellectual property right protection, libraries and databases.[91]

The European Union Innovation Scoreboard, states that both physical and knowledge infrastructure are more innovative than others. More information on this topic will be given in the third part of the thesis.

According to ***Smith***, there are two reasons for examining the role of such infrastructures in the establishment and stability of large technological systems or wider innovation systems: The first derives from simple empirical points about complex technologies or innovation systems: most in fact involve significant accompanying infrastructures. *Automobiles, consumer electric technologies, information* and *communications technologies, aeronautics,* and so on all rely on extremely substantial infrastructure investment; these seem to have powerful effects both in establishing the dominance of technologies within particular regimes, and in

[90] Erol Taymaz, **Ulusal Yenilik Sistemi: Türkiye İmalat Sanayiinde Teknolojik Değişim ve Yenilik Süreçleri**, TÜBİTAK, Ankara, 2001, p.29.

shaping the trajectories of the evolution of regimes. These impacts on shaping technology regimes are one way in which infrastructure shape the overall performance of national systems.

The second reason for examining the role of infrastructures concerns not the empirical role but their economic effects. Infrastructures can involve major network externalities, and they are often the place within a system where scale and scope economies are very significant. This implies that their existence or non-existence can significantly shape the fates of competing technologies, and thus the evolution of overall technologically economic systems.

There seems to be a necessary *'convergence'* of systems approaches to innovation and analyses of infrastructure. It is increasingly recognized that innovation decisions *(including decisions involving the diffusion of a new technology)* do not occur in isolation.[92]

According to ***Smith***, it is not difficult to see that decisions regarding either provision or pricing of infrastructure can have a major impact on economic performance and technological choice. There are more or less direct effects on industrial competitiveness, industrial structure, and the international or regional location of industry.

As this thesis consists of innovative enterprises and states, the relationship between innovation and privatization should be investigated. First of all, private firms have greater monetary advantages for research and development than state enterprises. On the other hand, a private firm or an enterprise must act more competitively in its market. Accordingly, in the private level of innovation there is more much competition involved, which means that firms must innovate continuously at every step of their work. ***Smith*** argued that, on the private level, technology infrastructure institutions include diverse groups such as: industry associations and conferences, training centers, trade publications, collectively established technical standards *(such*

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[91] Smith Keith, Economic Infrastructures and Innovation Systems, Chapter 4, **"http://www.tik.uio.no/esstasia.html".**
[92] Ibid.

as architecture and operating systems in computing), branch research institutes and so on. Public sector institutions include R&D programs, legal or administrative regulations, subsidies to capital stocks *(especially structures and scientific equipment),* and public procurement.

2.7 THE FUTURE OF INNOVATION PROCESS

According to ***Kuczmarski***, the days of reengineering costs out of the system and acquiring your way to financial prosperity are over. The hard work begins. Innovation is the *new business frontier*, and successful executives will be pioneers. Individuals can accept innovation and start creating an innovation mindset. In the following, innovation *mindsets* are reviewed:

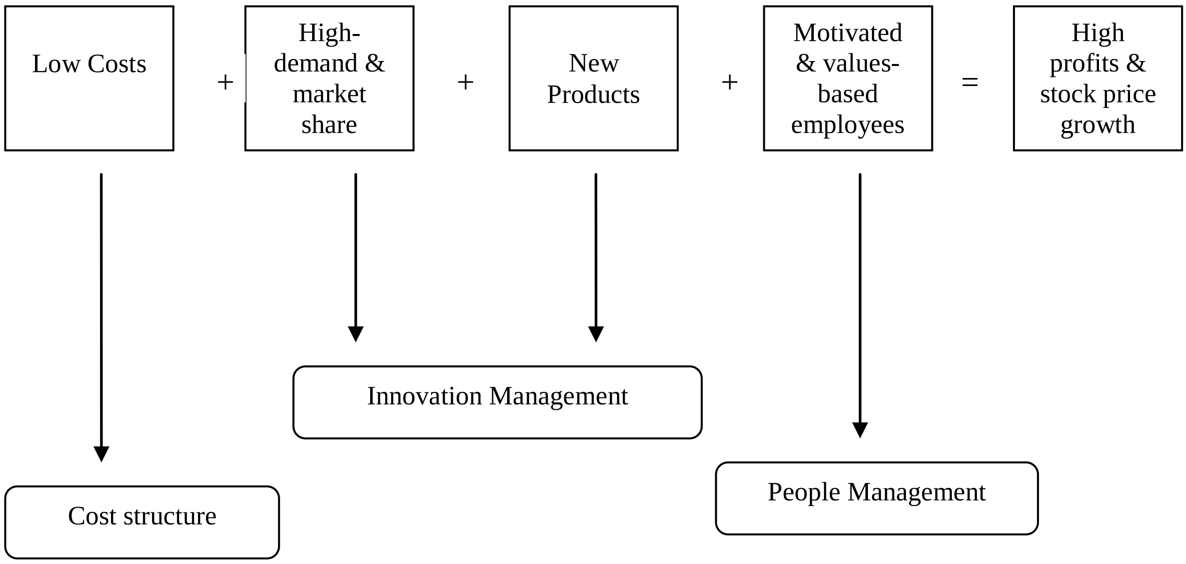
- Innovation will be linked to and *integrated* with business strategy.
- Innovation will become a separate function or department within a company.
- Shareholders will *appreciate* and *reward* innovation more and stock prices will reflect a company's effectiveness in innovation.
- Companies will measure returns on innovation as the level of investment and performance expectations increase.
- Team structures that reinforce an innovative mindset will be kept in place for long periods, and innovation will have its own career path.
- New compensation mechanisms will be developed to reinforce a more entrepreneurial and risk-sharing environment. [93]

Innovation is becoming and will continue to build steam as the core component of a company's business strategy in the 21st century. Continued focus on lowering costs will be only one ingredient in future business success. Top managers will also need to change their leadership approaches and pay more attention to their most valuable asset, people. *Effective innovation management* will make or break companies in the future.

The model for successful innovation is presented as follows:

[93] Kuczmarski, op.cit., p.81.

Figure 2.5 Emerging Formula for Successful Innovation



Source: Thomas D. Kuczmarski, **Innovation: Leadership Strategies for The Competitive Edge**, Chicago, American Marketing Association, NTC Publishing Group, 1995, p.81.

The components of the emerging formula for successful innovation are: low costs, high demand and market share, new products, motivated and values-based employees. These components lead to high profits and stock price growth in which cost structure, innovation management and people management are the issues that taken into consideration.

As it seen, the emerging formula for successful innovation includes every variable that effects innovation so even motivated & values-based employees are included in the formula. It is clear that, all the components, one by one have an importance but when they come together they make the real success for innovation.

PART III

EUROPEAN INNOVATION SCOREBOARD (EIS)

According to the European Union Innovation Scoreboard, The Lisbon European Council in March 2000 called for the enhancement of innovation in the Union as a response to globalization and the challenges of the knowledge-driven economy. It provides an overview of Europe's innovation performance by presenting data on 21 indicators relevant to the innovation process. The scoreboard uses traditional indicators based on R&D and patent statistics derived from recent surveys.[94]

3.1 EUROPEAN UNION FRAMEWORK PROGRAMMES

The European Union (EU) coordinates scientific framework programs to increase scientific research and technological development over five year periods. The goal is to increase the competency of scientific research and technological development activities within the society as well as establishing a positive impact on economical and social development. EU's aim is to act as an ***Information Society*** by innovation, competition, sustainable economical growth, social harmony and improved employment.

3.2 EUROPEAN INNOVATION SCOREBOARD 2002

The innovation scoreboard analyses statistical data on 21 indicators in four areas: *human resources; knowledge creation; transmission and application of new knowledge; innovation finance, output and markets*. The scoreboard depicts achievements and trends, highlights strengths and weaknesses of ***Member States' performances,*** and examines European convergence in innovation. The scoreboard is one of the benchmarking exercises of the European Commission that were launched in response to the Lisbon European Council. It builds on the "structural indicators" that the Commission offered in its Communication "To realize the potential of the European Union -consolidating and extending the Lisbon strategy"[95]

[94] Commission of The European Communities, op.cit., p.7
[95] Ibid.

3.3 ANALYSIS OF EIS 2002

The EIS complements the *Enterprise Policy Scoreboard* and other benchmarking exercises of the European Commission. It mainly uses *Eurostat Data* or private data of sufficient reliability if official data is not available. Six indicators are drawn from the European Commission's Structural indicators. All indicators have been updated based on data availability as of September 15, 2002. Four indicators could not be updated due to delays in the execution of the third *Community Innovation Survey (CIS)*. As a result, the 2002 EIS does not provide trend results for these indicators and it does not contain a summary innovation index similar to the one offered in 2001. Subject to the availability of new CIS data, the 2003 EIS is expected to offer again an updated composite innovation index and a comparison between the index and average trends for each country, which was one of the most interesting features of the 2001 EIS.[96]

3.3.1 Human Resources

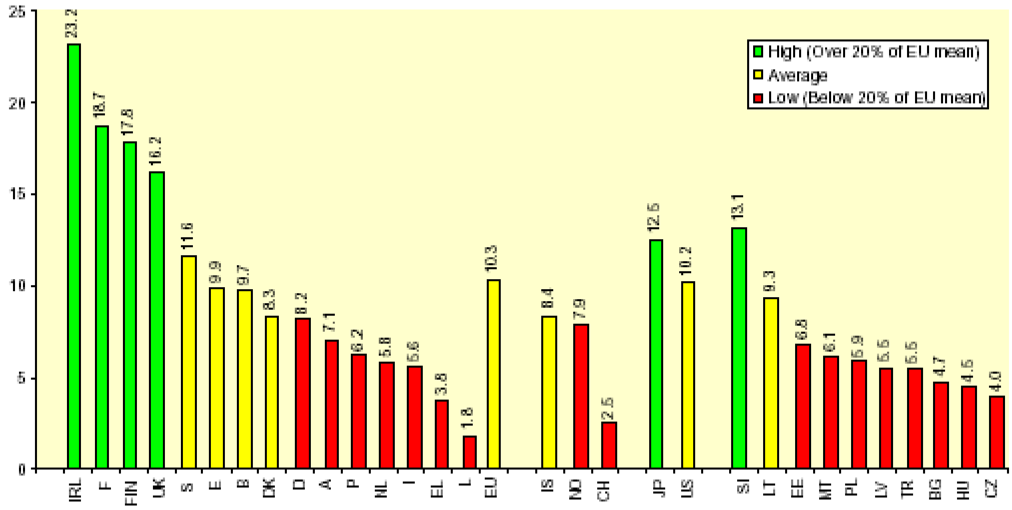
According to EIS, the first analysis is being interpreted in the area of human resources. The scale and quality of human resources are major determinants of both ***the creation of new knowledge*** and ***its diffusion throughout the economy***. The indicators are divided into two groups: three indicators for *education and learning* and two indicators for *employment*. The former include the supply of new scientists and engineers, the skill-level of the working age population, and a measure of life-long learning (one of the five "structural indicators"). For the first two indicators, data from US and Japan are available, but their comparability with European data may be limited due to differences between their education systems and those of Europe.

The two employment indicators are the share of the workforce in medium-high and high technology manufacturing and in high technology services. These indicators

[96] European Commission Enterprise Directorate-General, A publication from the Innovation/SMEs Programme, "European Trend Chart on Innovation, 2002 European Innovation Scoreboard", **Technical Paper No:4**, Indicators and Definitions, November 25, 2002, p.1

reflect the structural focus (or pattern of specialization) of each economy on sectors that are likely to have a high innovation content.

Figure 3.1 New S&E Graduates (% of 20 - 29 years age class)



Sources: EUROSTAT, Education statistics; GSO survey for CH, BG, EE, HU, LT, LV, MT and TR; years used: 2000 for all countries, except 1999 for CZ, DK, F, FIN, HU, I, PL and SI, 1996 for JP, 1995 for TR, and 1993 for EL.

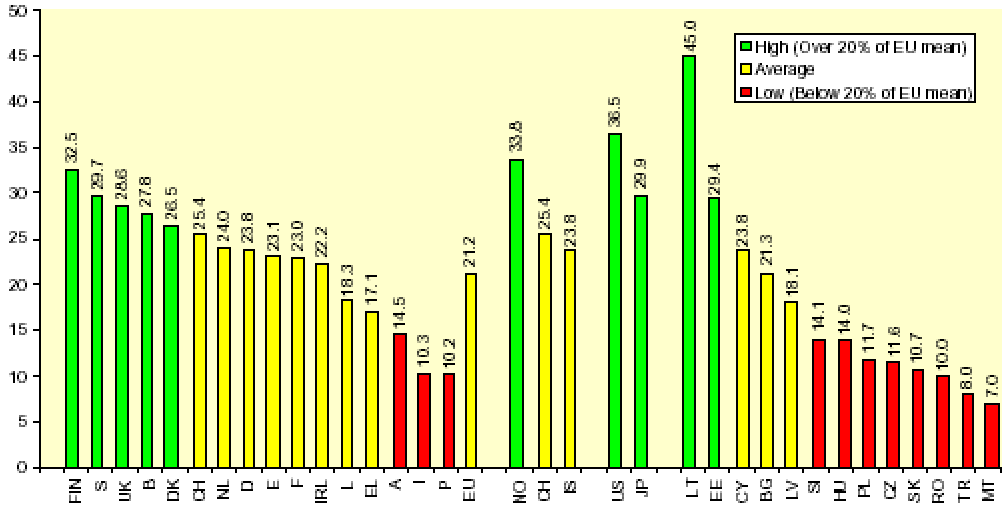
Definition

The reference population is all age classes between 20 and 29 years inclusive. Tertiary graduates in Science & Engineering (S&E) are defined as *all post-secondary education graduates, in life sciences, physical sciences, mathematics and statistics, computing, engineering and engineering trades, manufacturing and processing and architecture and building.*

Interpretation

The indicator is a measure of the supply of new graduates with training in Science & Engineering (S&E). Due to problems of comparability for educational qualifications across countries, this indicator uses *broad educational categories*. This means that it covers everything from graduates of one-year diploma programs to PhDs. A broad coverage can also be an advantage, since graduates of one-year programs are of value to incremental innovation in manufacturing production and in the service sector.

Figure 3.2 Population with Tertiary Education (% of 25 - 64 years age class)



Sources: EUROSTAT, Labour Force Survey; GSO survey for CH and MT; years used: 2001 for all countries, except 2000 for D, JP, L, S and US, 1999 for TR, and 1997 for IRL.

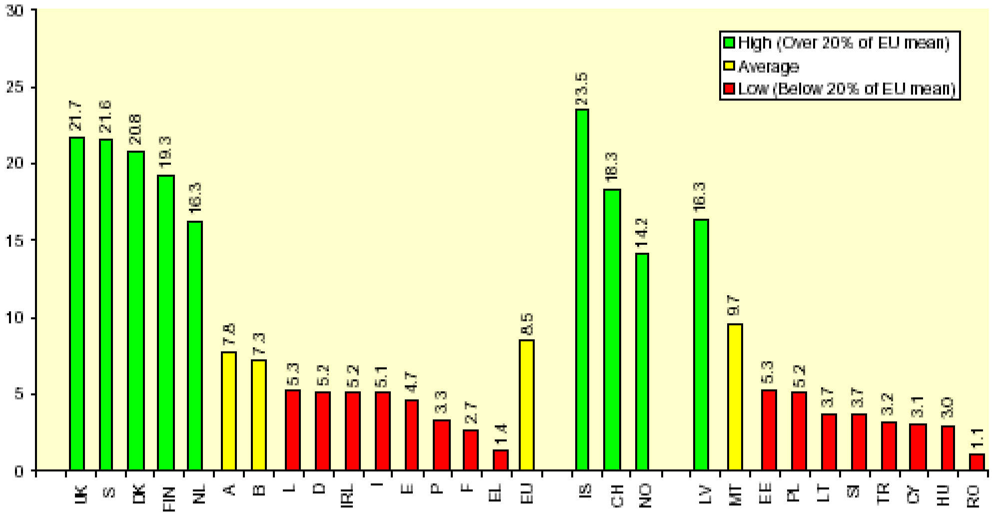
Definition

The definition of this indicator is the percentage of the *total working age population* (25-64 years age classes) with some form of postsecondary education.

Interpretation

This is a general indicator of the supply of advanced skills. It is not limited to science and technical fields because the adoption of innovations in many areas, particularly in the service sectors, depends on a wide range of skills. Furthermore, it includes the *entire working age population*, because future economic growth could require drawing on the non-active fraction of the population. International comparisons of educational levels however are notoriously difficult due to large discrepancies in educational systems, access, and the level of attainment that is required to receive a tertiary degree. Therefore, differences among countries should be interpreted cautiously.

Figure 3.3 Participation in Life-long Learning (% of 25 - 64 years age class)



Sources: EUROSTAT, Labour Force Survey; GSO survey for CH, LV, MT and TR; years used: 2001 for all countries, except 2000 for CY, 1999 for CH, 1997 for A and IRL, and 1996 for TR.

Definition:

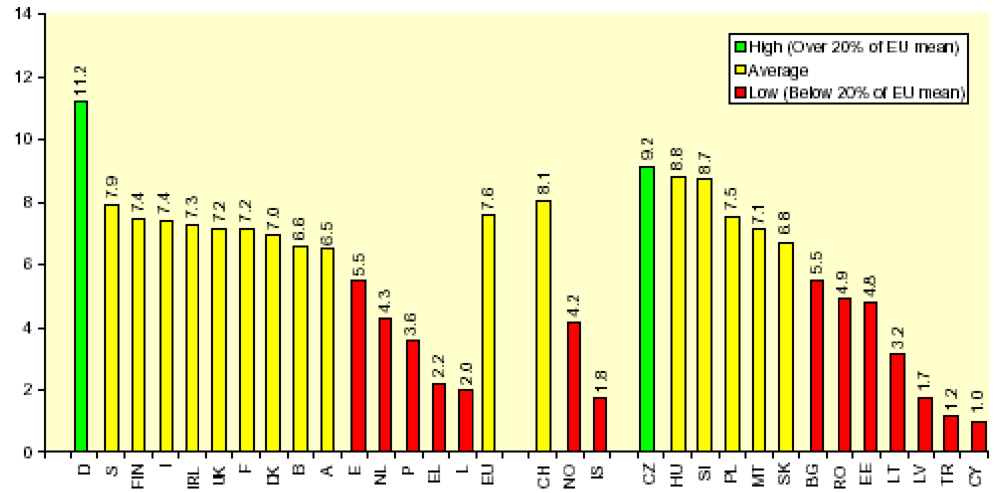
The reference population is all age classes between 25 and 64 years inclusive. A reference period of four weeks has been chosen in order to avoid distortion of information due to recall problems. The reference period is the last four weeks preceding the survey, except for *France, the Netherlands* (until 1999) and *Portugal* for which information is collected only if education or training is under way on the date of the survey.

Education includes *initial education, further education, continuing or further training, training within the company, apprenticeship, on-the-job training, seminars, distance learning, evening classes, self-learning, etc. as well as other courses followed for general interest: language, data-processing, management, art/culture, health/medicine courses.* Before 1998, education was related only to education and vocational training which was relevant for the current or possible future job of the respondent.

Interpretation

A central characteristic of a knowledge economy is continual technical development and innovation. Under these conditions, individuals need to continually learn new ideas and skills - or to participate in life-long learning. All types of learning are valuable, since it prepares people for *"learning to learn"*. The ability to learn can then be applied to new tasks with social or economic benefits. The limitation of the indicator to a brief window of four weeks could reduce comparability between countries due to differences in adult education systems. Little is known at this time about such differences, but differences in the timing of national holidays, preferred times for adult education courses, the average length of adult courses, and other unknown factors could influence the results and reduce comparability.

Figure 3.4 Employment in Medium-High and High-tech Manufacturing (% of total workforce)



Sources: EUROSTAT, Labour Force Survey; GSO survey for MT, PL and TR; years used: 2001 for all countries, except 2000 for S and TR, and 1999 for PL.

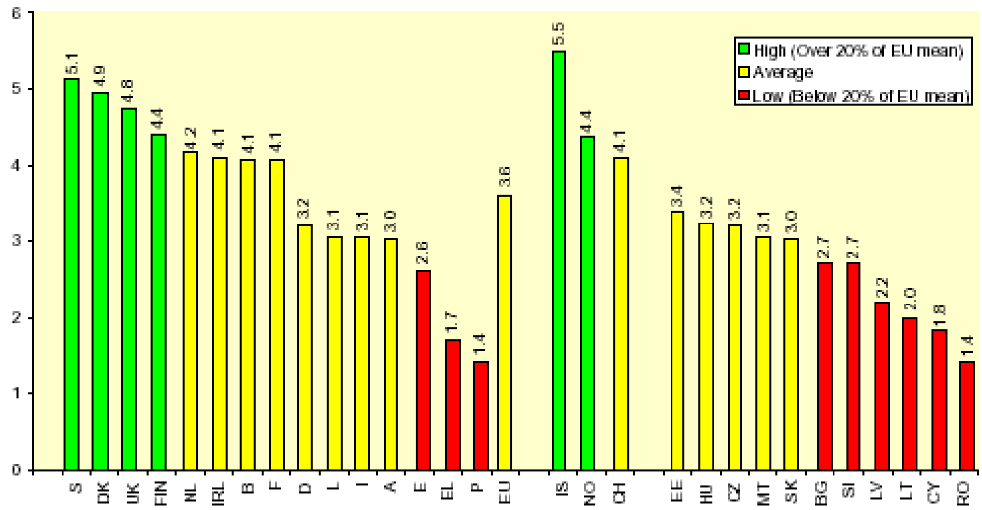
Definition

The medium-high and high technology sectors include *chemicals*, *machinery*, *office equipment*, *electrical equipment*, *telecom equipment*, *precision instruments*, *automobiles*, and *aerospace* and other transports. The total workforce includes all manufacturing and service sectors.

Interpretation

The percentage of employment in medium-high and high technology manufacturing sectors is an indicator of the share of the manufacturing economy that is based on continual innovation through creative, inventive activity. The use of total employment gives a better indicator than using the share of manufacturing employment alone, since the latter will be affected by the hollowing out of manufacturing in some countries.

Figure 3.5 Employment in High-tech Services (% of total workforce)



Sources: EUROSTAT, Labour Force Survey; GSO survey for MT; years used: 2001 for all countries, except 2000 for S.

Definition

This indicator focuses on three leading edge sectors that produce high technology services: *post and telecommunications*; *information technology including software development*; and *R&D services*. The total workforce includes all manufacturing and service sectors.

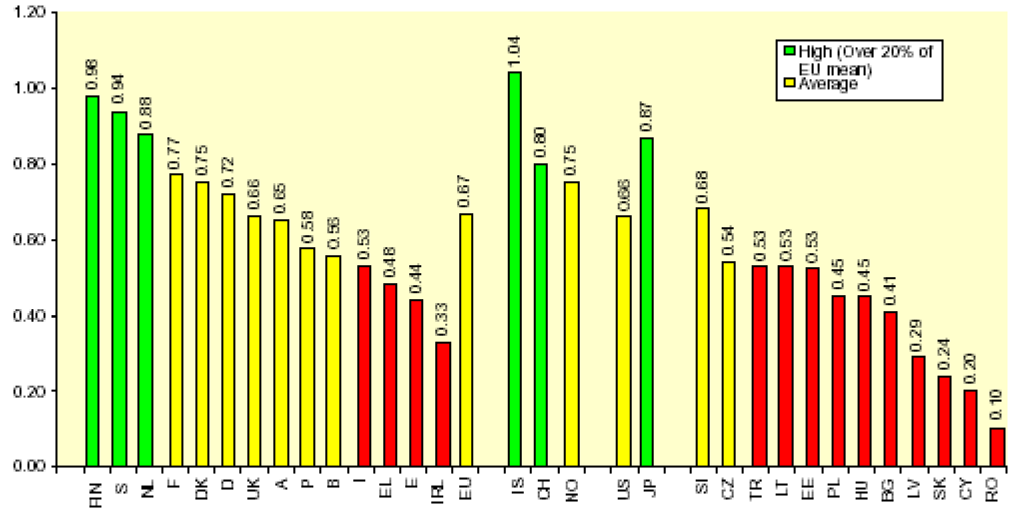
Interpretation

The high technology services both provide services directly to consumers, such as telecommunications, and provide inputs to the innovative activities of other firms in all sectors of the economy. The latter can increase productivity throughout the economy and support the diffusion of a range of innovations, particularly those based on ICT.

3.3.2 Knowledge Creation

According to EIS, the second area of interest is knowledge creation. The three indicators for the creation of knowledge measure inventive activity: ***public R&D expenditures***, ***business R&D*** (equivalent to the comparable structural indicator), and ***patenting***. The latter has two sub-categories: high technology patents at the *European Patent Office* (EPO) and high technology patents at the US Patent Office (USPTO).

Figure 3.6 Public R&D Expenditures (GERD - BERD) (% of GDP)



Sources: EUROSTAT, R&D statistics; GSO survey for CH, IS, BG, CZ, EE, HU, LT, LV and TR; years used: 2001 for D, E, FIN, IS, UK, 2000 for BG, CH, CZ, DK, EE, F, HU, JP, LT, LV, PL, SK, TR and US, 1999 for B, CY, EL, I, IRL, NL, NO, P, RO, S and SI, and 1998 for A.

Definition

The indicator is the percentage of GDP due to public R&D spending. The latter is defined as the difference between total R&D expenditures (GERD) and business enterprise expenditures (BERD). It thus includes higher education expenditure in

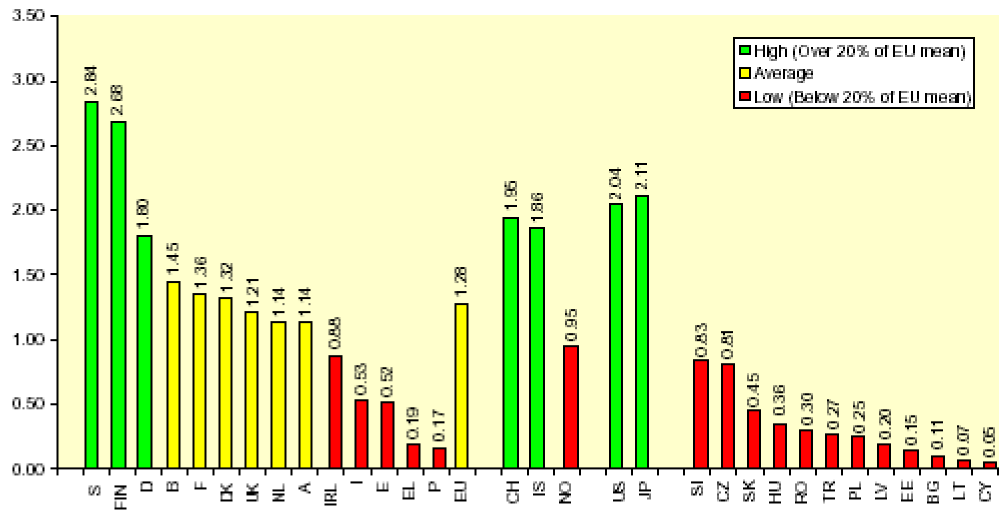
R&D (HERD), government expenditure in R&D (GORD) and private non-profit expenditure in R&D (PNRD).

Interpretation

In addition to the production of basic and applied knowledge in *universities* and *higher-education institutions*, publicly funded research offers several other outputs of direct importance to private innovation: trained research staff and new instrumentation and prototypes.

According to ***Innovation Scoreboard 2001***, the highest rates of public R&D were in *Finland, the Netherlands, Sweden*, and *France*, all of which compare favorably with the *US*. Within the EU, *Greece* and *Ireland* fall well below the average. The poor results for *Ireland*, in particular, contrast with relatively good results for many other indicators. It is known that *Ireland* was attracted foreign investment in high tech industries. The innovation scoreboard shows that *Ireland* is competitive in innovation mainly because of its private activities. It is not surprising to note a poor performance for public R&D since that need is fulfilled by foreign investment.

Figure 3.7 Business Expenditures on R&D (BERD) (% of GDP)



Sources: EUROSTAT, R&D statistics; GSO survey for CH, IS, BG, CZ, EE, HU, LT, LV and TR; years used: 2001 for D, E, FIN, IS, UK, 2000 for B, BG, CH, CZ, DK, EE, F, HU, JP, LT, LV, PL, SK, TR and US, 1999 for CY, EL, IRL, NL, NO, P, RO, S and SI, and 1998 for A.

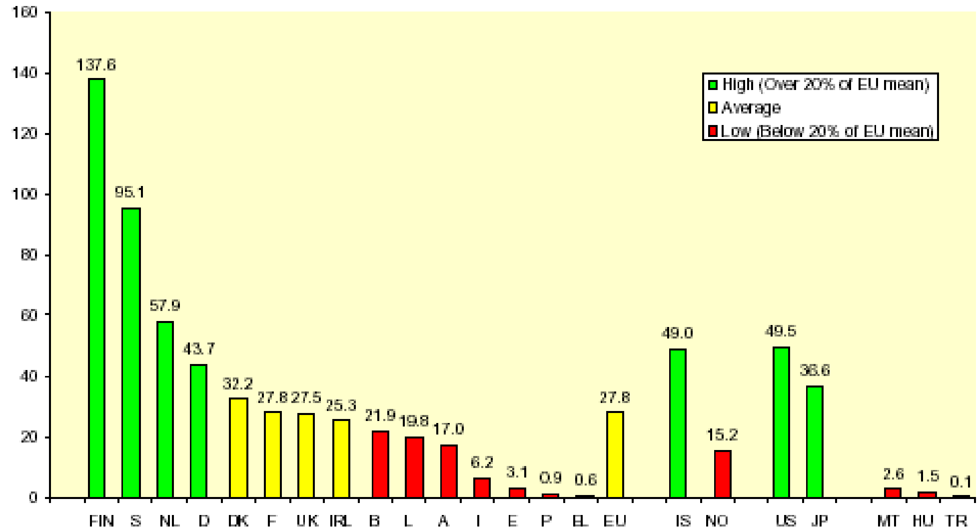
Definition

This indicator measures the R&D expenditure (from all sources of funding) of the business sector (manufacturing and services) as a percentage of GDP.

Interpretation

The indicator captures the formal creation of new knowledge *within firms*. It is particularly important in the science-based sectors (pharmaceuticals, chemicals and some areas of electronics) where most new knowledge is created in or near R&D laboratories.

Figure 3.8 EPO High Tech Patent Applications (per million population)



Sources: EUROSTAT; GSO survey for HU, MT and TR; years used: 2000 for all countries, except 1999 for MT, and 1998 for TR.

Definition

The indicator is defined as the *number of patent applications* (reference year is year of filing) at the EPO in high-technology patent classes per million population. The national *(and regional)* distribution of the patent applications is assigned according to the address of the inventor. The high technology patent classes include pharmaceuticals, biotechnology, information technology, and aerospace. The following IPC subclasses are included:

B41J: *typewriters; selective printing mechanisms, for example mechanisms printing otherwise than from a form; correction of typographical errors*
G06C: *digital computers in which all the computation is effected mechanically*
G06D: *digital fluid-pressure computing devices*
G06E: *optical computing devices*
G06F: *electric digital data processing*
G06G: *analogue computers*
G06J: *hybrid computing arrangements*
G06K: *recognition of data; presentation of data; record carriers; handling record carriers*
G06M: *counting mechanisms; counting of objects not otherwise provided for*
G06N: *computer systems based on specific computational models*
G06T: *image data processing or generation, in general*
G11C: *static stores*
B64B: *lighter-than-air aircraft*
B64C: *aero planes; helicopters*
B64D: *equipment for fitting in or to aircraft; flying suits; parachutes; arrangements or mounting of power plants or propulsion transmissions*
B64F: *ground or aircraft-carrier-deck installations*
B64G: *cosmonautics; vehicles or equipment therefore*
C12M: *apparatus for enzymology or microbiology*
C12N: *micro-organisms or enzymes; compositions thereof; propagating, preserving, or maintaining micro-organisms; mutation or genetic engineering; culture media*
C12P: *fermentation or enzyme-using processes to synthesize a desired chemical compound or composition or to separate optical isomers*
C12Q: *measuring or testing processes involving enzymes or micro-organisms*
H01S: *devices using stimulated emission*
H01L: *semiconductor devices; electric solid state devices not otherwise provided for*
H04B: *transmission*
H04H: *broadcast communication*
H04J: *multiplex communication*

H04K: *secret communication; jamming of communication*

H04L: *transmission of digital information, for example: telegraphic communication*

H04M: *telephonic communication*

H04N: *pictorial communication, for example: television*

H04Q: *selecting*

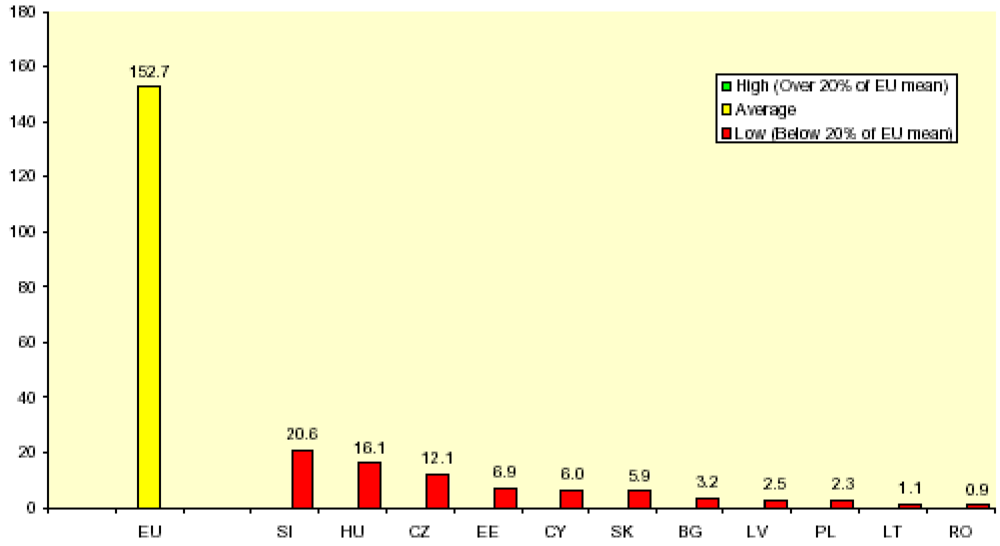
H04R: *loudspeakers, microphones, gramophone pick-ups or like acoustic electromechanical transducers; deaf-aid sets; public address systems*

H04S: *stereophonic systems*

Interpretation

This indicator complements indicator business R&D in that patenting captures new knowledge created anywhere within a firm and not just within a formal R&D laboratory. The indicator also measures specialization of knowledge creation in fast-growing technologies.

Figure 3.9 EPO Patent Applications (per million population)



Source: EUROSTAT; years used: 2000 for all countries.

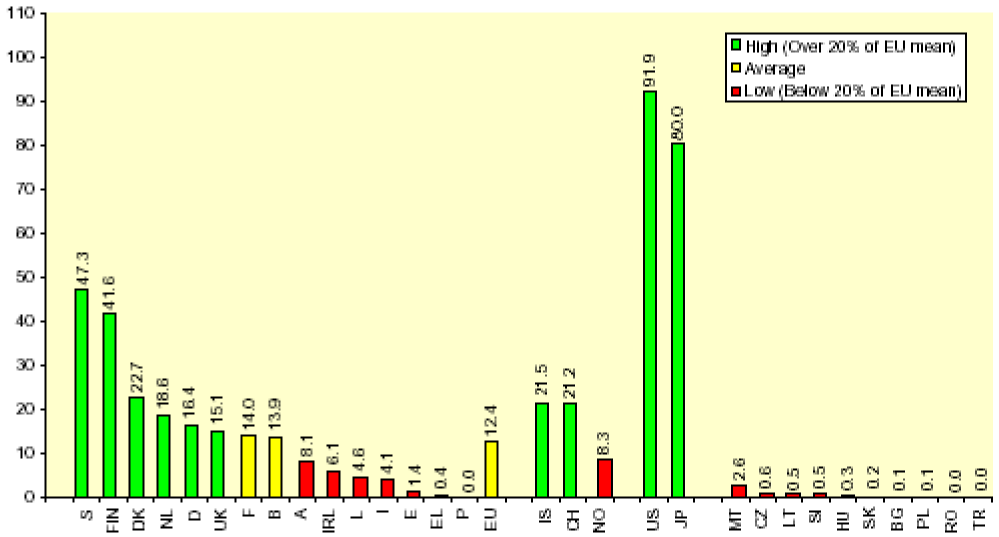
Definition

The indicator is defined as the number of all patent applications at the EPO per million population. The national *(and regional)* distribution of the patent applications is assigned according to the address of the inventor.

Interpretation

This indicator complements the indicator on business R&D in that patenting captures new knowledge created anywhere within a firm and not just within a formal R&D laboratory. In addition, this indicator is used for candidate countries as an alternative for an indicator of *"EPO high-tech patent applications (per million population)"* as the numbers for high-technology EPO patent applications are too small.

Figure 3.10 USPTO High Tech Patent Applications (per million population)



Sources: USPTO; GSO survey for CH and MT; years used: 2000 for all countries, except 2001 for MT, 1999 for SK, 1998 for LT, 1997 for BG and TR, and 1995 for RO.

Definition

The indicator is defined as the number of patent applications at the US Patent and Trade Mark Office (USPTO) in high-technology patent classes, per million population.

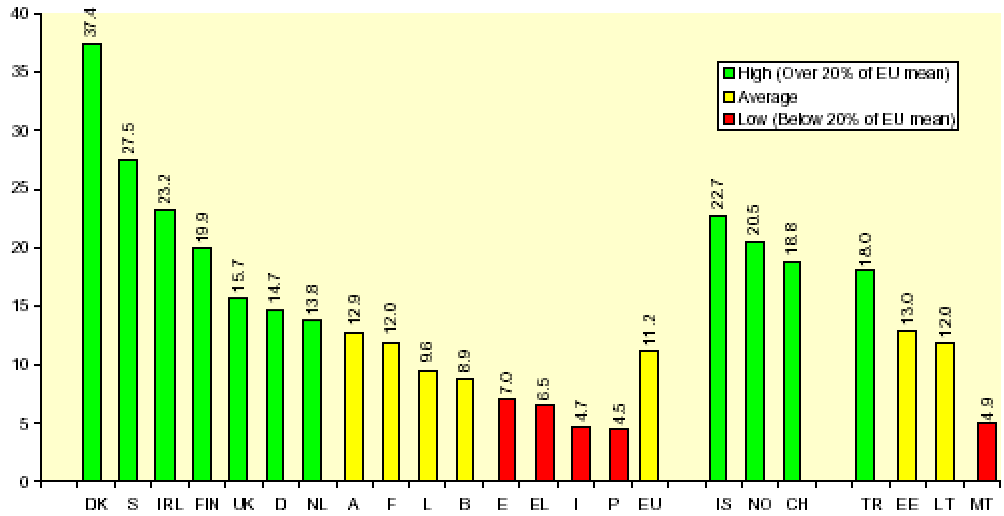
Interpretation

Indicator EPO patent applications favors European versus *American* and *Japanese* firms. The present indicator provides the equivalent for American firms and measures US patenting activity by European inventors.

3.3.3 Transmission and Application of Knowledge

Due to EIS, the third area covers innovation activities outside formal invention, such as ***the adaptation of new equipment to a firm's production*** and ***service systems***, ***adopting innovations developed by other firms or organizations***, and ***adapting new knowledge to the firm's specific needs***. Collecting data in this area is relatively new to the national and international statistical systems. The section therefore relies entirely on the second Community Innovation Survey (CIS-2) which is the only source of comparable European data for innovation diffusion. The indicators on in-house innovation and co-operative innovation are limited to small and medium-sized enterprises (SMEs). They provide a better picture of the innovative status of SMEs than business R&D, which is more prevalent among large firms. Separate data for SMEs is worthwhile because they form the majority of firms in most countries and can play a *vital role in innovation*: as intermediaries between the public research infrastructure and large firms, as developers of new ideas, and as adopters of new technology.

Figure 3.11 SMEs Innovating In-house (% of manufacturing SMEs)



Sources: EUROSTAT, Community Innovation Survey; GSO survey for CH, IE, NO, EE, LT, MT and TR; years used: 1996 for all countries, except 2000 for EE, 1999 for CH, 1998 for E, EL, IS, LT, MT and NL, and 1997 for NO and TR. Note that this indicator has not been updated in the 2002 Scoreboard for the Member States, as results from CIS3 are not yet available.

Definition

Innovative manufacturing firms are defined as those who introduced new products or process either:

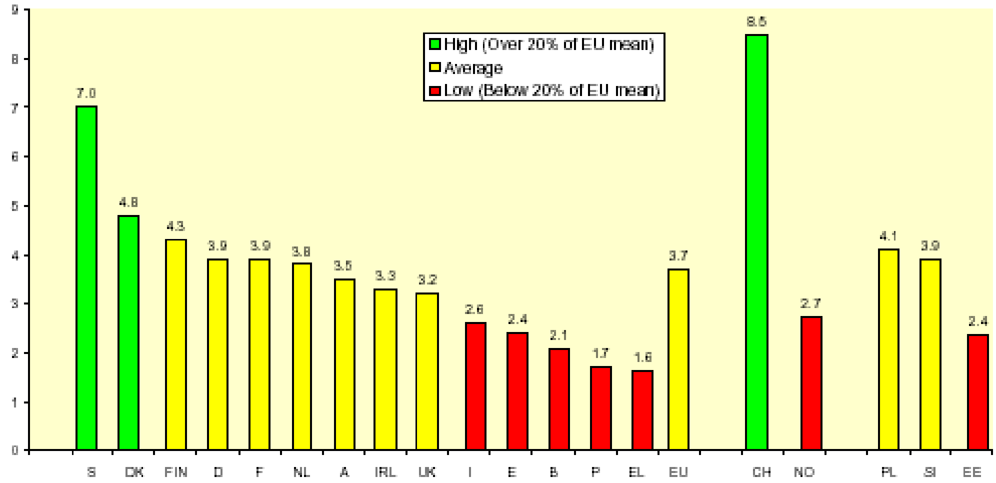
- *In-house or*
- *In combination with another firm(s)*

This indicator does not include new products or processes developed by other firms. Only SMEs with 20-249 employees are taken into account in CIS 2. Small and medium-sized enterprises (SMEs) are characterized as those enterprises with 20-249 employees.

Interpretation

The CIS defines innovative manufacturing firms quite broadly as those who introduced new products or processes developed by 1) *other firms*, 2) *in house*, or 3) *in combination with other firms*. The present indicator is more focused in two respects. It is limited to SMEs because almost all large firms innovate and because countries with an industrial structure weighted to larger firms would tend to do better. And it is limited to firms with in-house innovative activities that either develop product or process innovations themselves, or in combination with other firms.

Figure 3.12 Manufacturing SMEs Involved in Innovation Co-operation



Sources: EUROSTAT, Community Innovation Survey; GSO survey for CH, NO and EE; years used: 1996 for all countries, except 2000 for EE, 1999 for CH, PL and SI, 1998 for D, E and EL, and 1997 for NO. Note that this indicator has not been updated in the 2002 Scoreboard for the Member States, as results from CIS3 are not yet available.

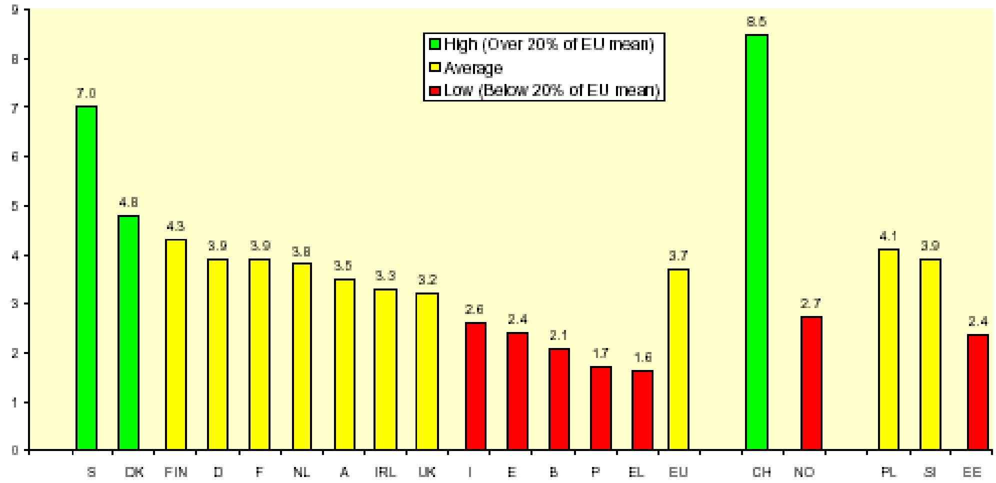
Definition

The indicator is the percentage of all manufacturing SMEs *(including non-innovators)* with 20 or more employees that had any co-operation agreements on innovation activities with other enterprises or institutions in the three years before the survey.

Interpretation

Complex innovations, particularly in ICT, often depend on the ability to draw on diverse sources of information and knowledge, or to collaborate on the development of an innovation. This indicator measures *the flow of knowledge between public research institutions* and *firms* and *between firms* and *other firms*. The indicator is limited to SMEs because almost all large firms are involved in innovation co-operation. This indicator also captures technology-based small manufacturing firms, since most are involved in co-operative projects. However, the indicator will miss high-technology firms with no product sales, such as many biotechnology firms, because these firms are assigned to the service sector.

Figure 3.13 Innovation Expenditures (% of all turnovers in manufacturing)



Sources: EUROSTAT, Community Innovation Survey; GSO survey for CH, NO and EE; years used: 1996 for all countries, except 2000 for EE, 1999 for CH, PL and SI, 1998 for D, E and EL, and 1997 for NO. Note that this indicator has not been updated in the 2002 Scoreboard for the Member States, as results from CIS3 are not yet available.

Definition

This indicator includes all manufacturing firms with 20 or more employees. Innovation expenditures includes the full range of innovation activities: *in-house R&D, extramural R&D, machinery* and *equipment linked to product* and *process innovation, spending to acquire patents* and *licenses*, *industrial design*, *training*, and *the marketing of innovations*. Total innovation expenditure by all firms in each country is divided by total turnover. This includes firms that do not innovate, whose innovation expenditures are zero by definition.

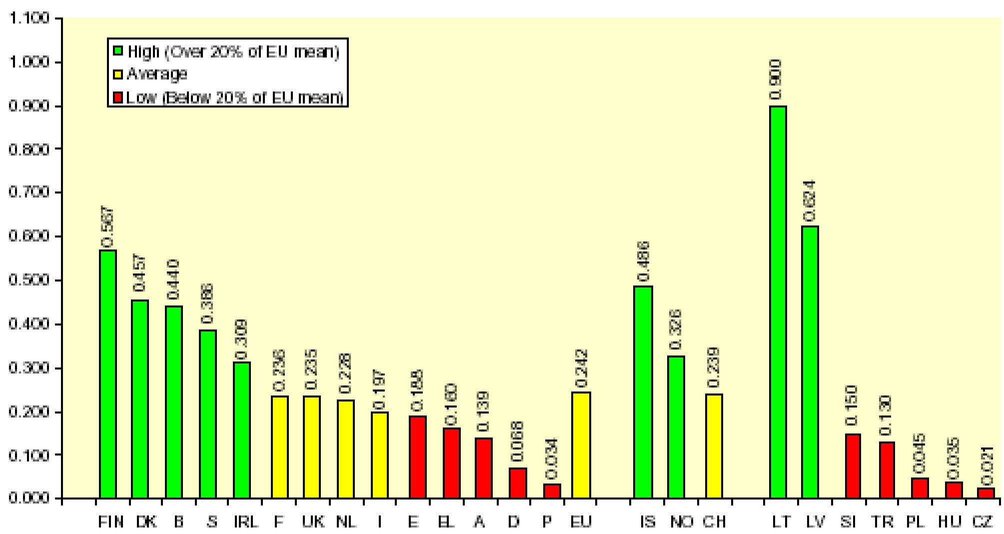
Interpretation

Several of the components of innovation expenditure, such as *investment in equipment and machinery and the acquisition of patents and licenses, measure the diffusion of new production technology and ideas*. Overall, the indicator measures total expenditures on many different activities of relevance to innovation. The indicator partly overlaps with indicator R&D expenditures. A better version would exclude R&D, but concerns over data reliability have prevented this option.

3.3.4 Innovation Finance, Output and Markets

This group includes six indicators that cover a range of issues: ***the supply of high-tech venture capital, capital … on stock markets*** *(new markets or newly admitted firms on main markets)*, ***sales from innovations***, ***home internet access*** *(structural indicator)*, ***ICT investment*** *(structural indicator)*, and ***value-added in advanced manufacturing sectors***. Three of these indicators are based on private sources due to a lack of equivalent public data, but they are included because of their high policy interest. The main drawback to using private data is that there is less information available on how the data are obtained. This makes it difficult to assess their reliability.[97]

Figure 3.14 High Technology Venture Capital Investments (% of GDP)



Sources: European Private Equity & Venture Capital Association (EVCA); GSO survey for HU, LT, LV and TR; years used: 2001 for all countries, except 2000 for D, and 1999 for CZ, PL and SI.

[97] Commission of the European Communities, Commission Staff Working Paper, **2001 Innovation Scoreboard**, Brussels, 14.09.2001, Sec (2001) 1414, p.7-8

Definition

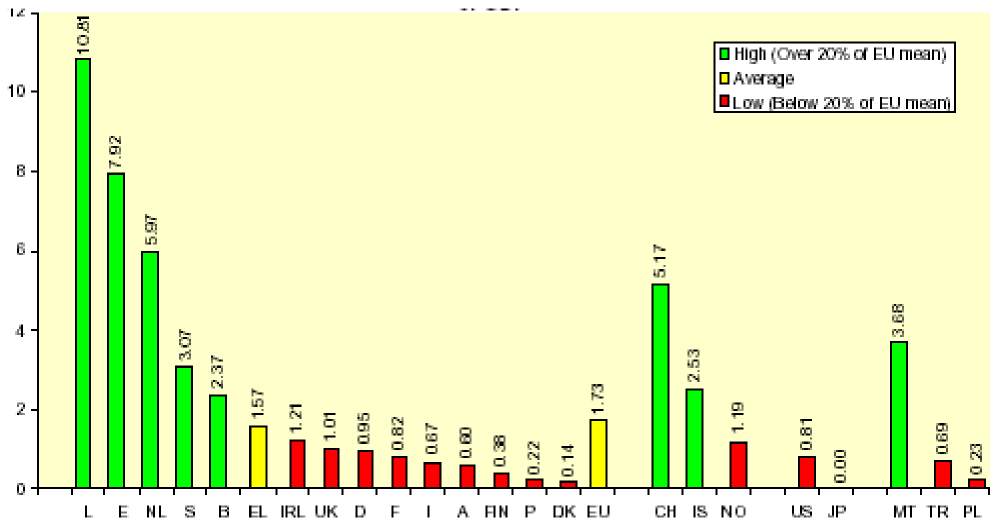
The percentage of GDP due to venture capital in high technology firms active in the following sectors: *computer related fields, electronics, biotechnology, medical or health, industrial automation, financial services*. Venture capital is the sum of early stage capital *(seed and start-up)* plus expansion capital.

The data for this indicator were taken from EVCA's *"Mid-Year Survey of Pan-European Private Equity & Venture Activity"*. More recent data for high-tech venture investments including replacement and buyout capital are available in EVCA's *"Yearbook: Annual Survey of Pan-European Private Equity & Venture Capital Activity"*. The Yearbook however does not provide disaggregated data to calculate high-tech venture capital investments according to the EIS definition and these data have thus not been used.

Interpretation

One of the main barriers to innovation is the ability of new technology-based firms to raise adequate funding. This indicator measures the supply of private venture capital to these firms. The total supply of capital will be higher because of bank and private-placement financing. The main disadvantage is that there are many alternative methods of financing new technology-based start-up firms that are not covered by this indicator. Firms can also go abroad to raise venture capital. An additional concern is the lack of information on the accuracy of the venture capital data.

Figure 3.15 New Capital raised on Stock Markets (% of GDP)



Source: World Federation of Stock Exchanges (FIBV); years used: average of 2000 and 2001 for all countries, except average of 1999 and 2000 for PL.

Definition

This indicator is the amount of new capital raised by domestic firms on domestic stock markets as a percentage of GDP. It excludes investment funds and unit trusts. And, in order to focus the indicator on new innovative firms, the indicator excludes capital raised by existing firms on the main stock exchanges. Three types of new capital are included:

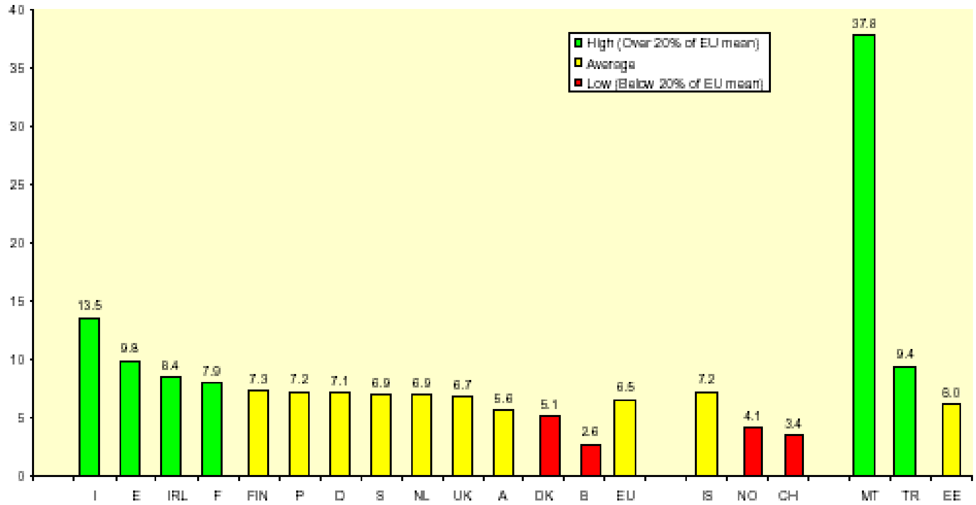
- capital raised by newly admitted firms to the main *stock exchanges*
- capital raised on parallel markets by *already listed* firms
- capital raised on parallel markets by *newly admitted* firms.

The focus on new capital that is probably raised by innovative firms in high technology sectors differentiates this indicator from the Structural indicator *"Capital raised on stock markets"*, which includes all capital raised on stock markets, including capital raised on the main markets. Parallel stock exchanges focus on high technology sectors.

Interpretation

New capital is a major source of investment for many firms, but particularly for fast growing firms in high technology sectors. The indicator is strongly influenced by volatility in capital markets: it includes stocks that have little to do with technology. Firms raising capital in foreign markets will distort the results.

Figure 3.16 'New To market' Products (% of sales by manufacturing firms)



Sources: EUROSTAT, Community Innovation Survey; GSO survey for CH, IS, NO, EE, MT and TR; years used: 1996 for all countries, except 2000 for EE, 1999 for CH and MT, 1998 for D, E and IS, and 1997 for NO and TR. Note that this indicator has not been updated in the 2002 Scoreboard for the Member States as results from CIS3 are not yet available.

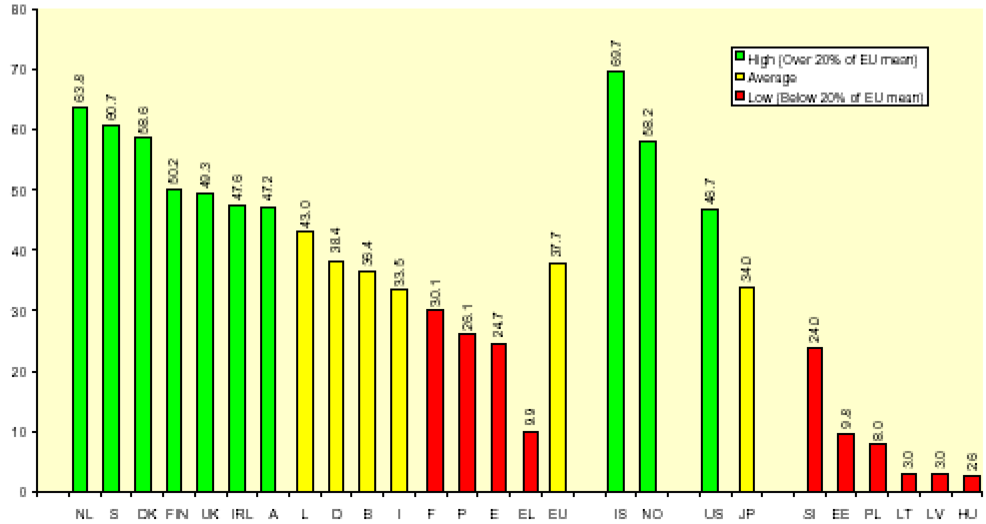
Definition

The amount of *product sales* (or total turnover), by manufacturing firms with more than 20 employees, from innovations that are new to the firm's market. These are limited to products that are both new to the firm itself and new to the firm's market.

Interpretation

This is a direct output measure of innovation that is not distorted by market speculation *(as would the market value of a firm).* The product must be new to the firm, which in many cases will also include innovations that are world-firsts. The main disadvantage is that there is some ambiguity in what constitutes a *'new to* *market'* innovation. Smaller firms or firms from less developed countries could be more likely to include innovations that have already been introduced onto the market elsewhere.

Figure 3.17 Home Internet Access (% of all households)



Sources: EUROSTAT/Eurobarometer; GSO survey for EE, HU and LV; years used: 2001 for all countries, except 2000 for JP, HU and LV.

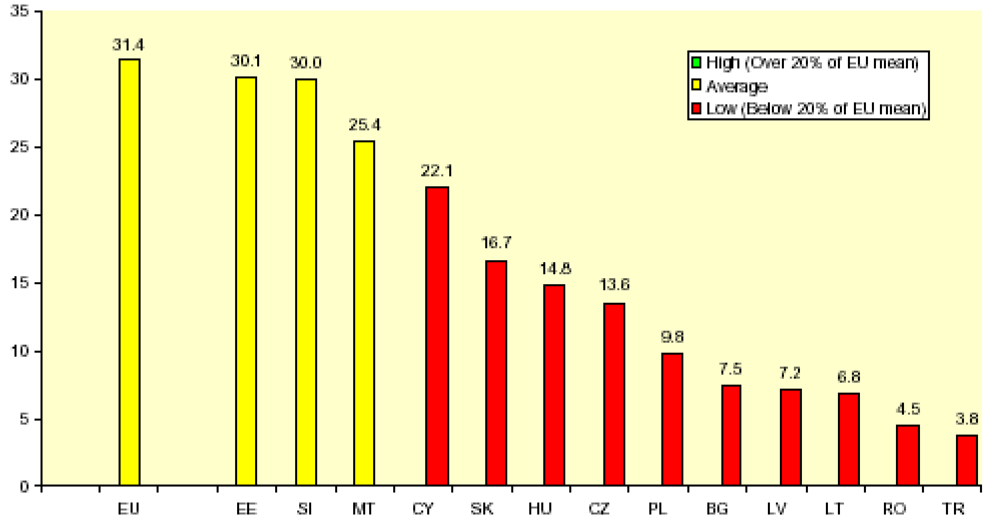
Definition

Percentage of households who have internet access at home. All forms of use are included. Population considered is equal to or over 15 years old. This indicator is identical to indicator of level of internet access.

Interpretation

Internet use by the domestic population is a measure of the ability to access an enormous wealth of *data on-line, including business to consumer, e-commerce* and *government to citizen online services*. In the future, much more sophisticated measures of internet use will be needed. Better data is needed on what the internet is used for and if the population is aware of several efficiency enhancing uses.

Figure 3.18 Internet Access (% of population)



Source: EUROSTAT; years used: 2001 for all countries.

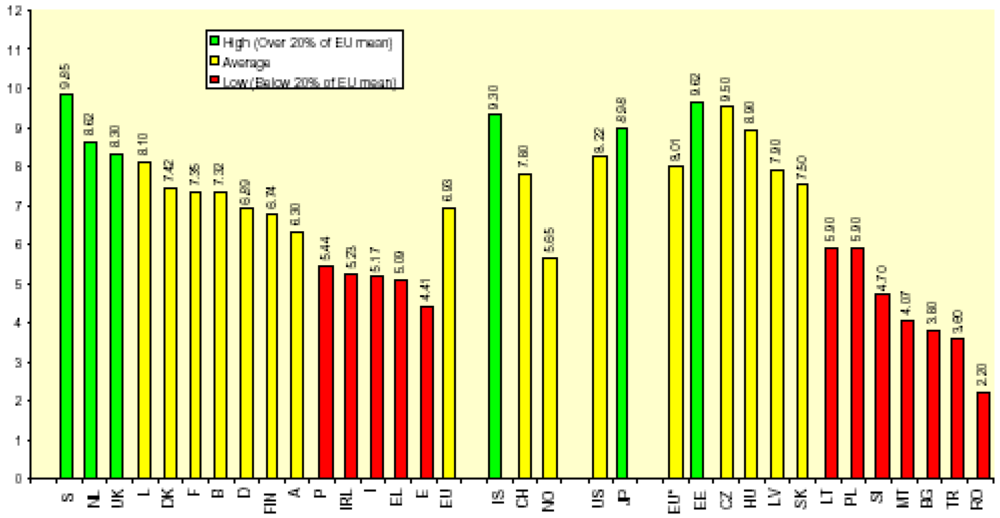
Definition

Percentage of population that has *any form of internet access*. All forms of use are included. Population considered is equal to or over 15 years old.

Interpretation

Internet use by the domestic population is a measure of the ability to access an enormous wealth of data on-line, including *business-to-consumer e-commerce and government-to-citizen online services.* In the future, much more sophisticated measures of internet use will be needed. Better data is needed on what the internet is used for and if the population is aware of several efficiency enhancing uses.

Figure 3.19 ICT Expenditures (% of GDP)



Sources: EUROSTAT; WITSA/IDC (Digital Planet) for Candidate countries and EU*; GSO survey for IS and MT; years used: 2001 for all countries, except 2000 for LT, LV, MT, JP and US.

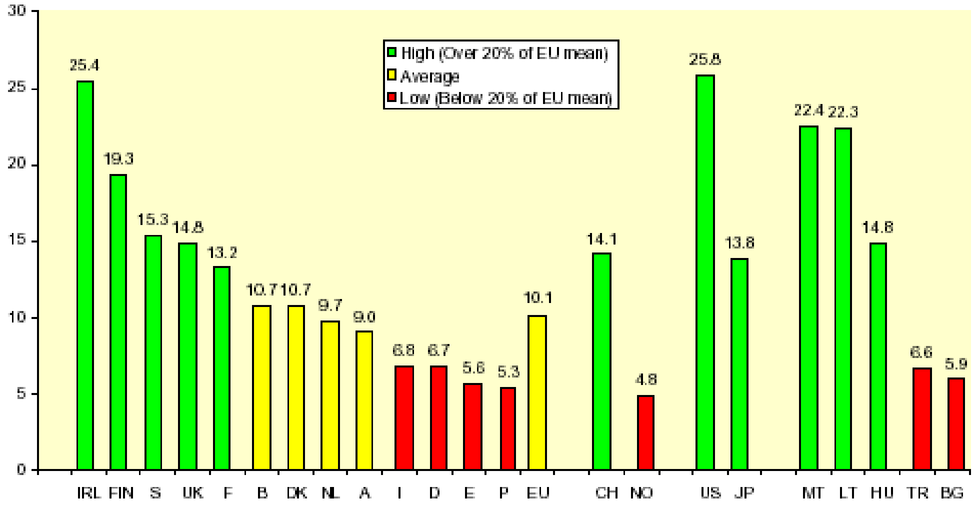
Definition

This indicator measures total expenditures on *Information and Communication Technology* (ICT) as a percentage of GDP. ICT includes office machines, data processing equipment, data communication equipment, and telecommunications equipment, plus related software and telecom services.

Interpretation

ICT is a fundamental feature of knowledge based economies and the driver of current and future productivity improvements. An indicator for ICT investment is crucial for capturing innovation in knowledge-based economies, particularly due to the diffusion of new IT equipment, services, and software. One disadvantage of this indicator is that it is ultimately obtained from private sources (IDC), with a lack of good information on the reliability of the data. Another disadvantage is that some expenditures are for final consumption and may have few productivity or innovation benefits. It would be preferable to have data on ICT investment rather than ICT expenditure, but reliable investment data are not yet available.

Figure 3.20 Share of Manufacturing Value-added in High-tech Sectors



Sources: EUROSTAT, Structural Business Statistics; GSO survey for CH, NO, BG, EE, HU, LT, MT, TR; years used: 1999 for all countries, except 2000 for BG, HU and TR, 1998 for LT and MT, and 1997 for JP and US.

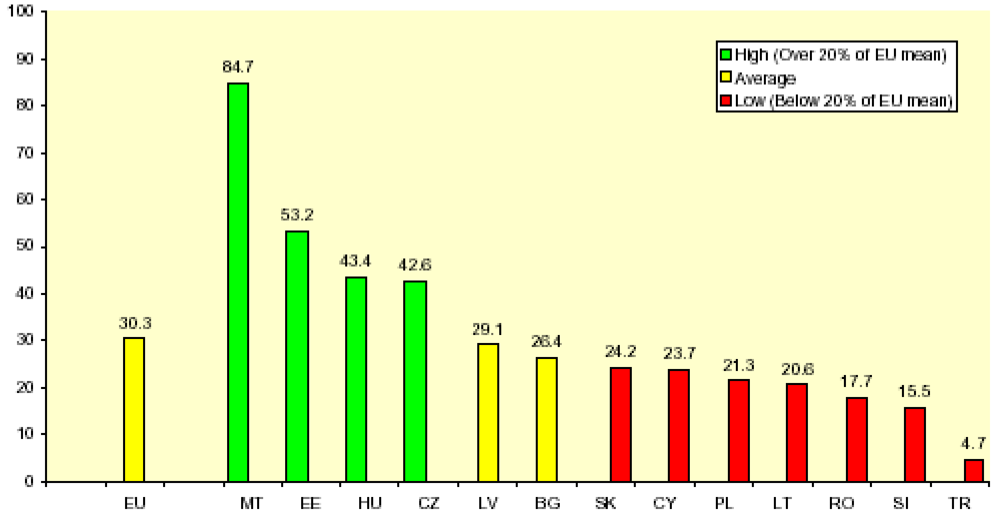
Definition

This is the percentage of total value added in manufacturing in four high technology industries: *pharmaceuticals*, *office equipment*, *telecommunications* and *related equipment*, and *aerospace*.

Interpretation

Value-added is the best *measure* of manufacturing output, whereas other indicators such as total production can be biased by 'screwdriver' plants with little value-added. The requirement for good data on value added creates a lag of two or more years longer than for GDP and other economic data. The main disadvantage of the main indicator is that a hollowing-out of manufacturing, as in the UK, can lead to relatively good results, if low and medium technology industries no longer survive.

Figure 3.21 Stock of Inward FDI (% of GDP)



Source: UNCTAD (World Investment Report); years used: 2000 for all countries.

Definition

The indicator is defined as the stock in inward *Foreign Direct Investment (FDI)* as a percentage of GDP. UNCTAD defines *FDI* as an investment involving a long-term relationship and reflecting a lasting interest and control by a resident entity in one economy *(foreign direct investor or parent enterprise)* or in an enterprise resident in an economy other than that of the foreign direct investor *(FDI enterprise or affiliate enterprise or foreign affiliate)*. *FDI* implies that the investor exerts a significant degree of influence on the management of the enterprise resident in the other economy. Such investment involves both the initial transaction between the two entities and all subsequent transactions between them and among foreign affiliates, both incorporated and unincorporated."

Interpretation

The inflow of *FDI* steers production towards higher value-added goods, or increases production efficiency. Both can depend on the transfer of foreign technology and provide, a potential for conducting industrial research in the host country. Stock data are a better proxy for the rate of penetration of *FDI* and also neutralize large variations in annual inflows.[98]

3.4 ANALYSIS OF EIS 2002 COMPARISON OF EU, US AND JAPAN

- **Weak innovation performance of the EU as a whole:** *The 2002 European Union Innovation Scoreboard (EIS)* confirms that the innovation performance of the EU is still low compared to its main global competitors. ***Japan*** leads the EU in eight of the *ten* indicators for which comparable data are available, and the ***US*** leads in seven. For *new S&E graduates* and *public R&D expenditures*, the EU and US' averages are very close. The only significant EU lead within the triad is its lead over Japan in home Internet access.

- **Encouraging trend results:** Looking at trends, the situation is more encouraging. For five of eight comparable trend indicators the EU trend has been improving faster than in the US. The ***US*** trend leads the EU for high technology *EPO patents* and for *business R&D*, while there is an equal decline in the both the US and EU for *public R&D*. Compared to ***Japan***, the EU leads in all seven available trend indicators. These overall positive trend results suggest that the EU may be *catching up* with its main competitors.

- **Persisting gaps in business R&D and high-tech patenting:** However, the two major weaknesses diagnosed in 2001 continue to exist in EPO high-tech patents. EU growth has been substantial (up 55%), but ***US*** high-tech patenting in Europe is growing still faster (up 67.8%). In business R&D, the lower rate of increase in the EU than in the US is of particular concern, since this indicator from one of its main competitors.

- **World innovation leaders come from Europe:** Looking at individual Member States, the 2002 EIS confirms that the world's leading countries for many innovation indicators are found within the EU. The leading innovative countries in the EU are the smaller northern economies, including *Finland,*

[98] Ibid., European Commission- Enterprise Directorate-General.

Sweden, Denmark and *The Netherlands*. The ***UK*** is the most innovative of the larger economies. For seven of the ten comparable indicators, the EU leaders are ahead of both the US and Japan. Ireland, France, Finland, UK and Sweden lead in new S&E graduates; Finland, Sweden and The Netherlands in high-technology EPO patents; Luxembourg, Spain and The Netherlands in new capital raised; The Netherlands, Sweden and Denmark in home Internet access; and Sweden, UK and The Netherlands *in ICT expenditures.*[99] According to the analysis of ***Göker***, from 1990's till today Germany, France, U.K and Holland have been continuously working on technology foresight research projects. In addition, Austria, Ireland, Portugal and Sweden completed their reseats and plans for technology foresight recently. In addition, Greece is beginning to develop a technology foresight program.[100]

- **Southern Europe catching up:** Some of the southern European countries are showing rapid improvements. In ***Portugal*** and in ***Greece*** both business and public R&D are improving much more rapidly than the EU average. ***Spain*** is substantially above the average EU trend for employment in high technology services and high technology patents. ***Italy*** does not exhibit major improvements.

- **The Associate Countries:** The 2002 EIS provides comparable data for ***Switzerland, Iceland*** and ***Norway***. ***Switzerland*** and ***Iceland*** are above the EU mean for 10 and 11 indicators respectively, which makes them comparable to the EU innovative leaders. However, the trend results for Switzerland are behind the EU average for six of eight indicators, suggesting that Switzerland may be loosing its innovative advantage. The very good results for Iceland in several indicators of business innovation (business R&D, patents, and finance) are largely due to its proactive cluster and FDI policy in biotechnology. Norway is a middle range country that does very well in several indicators for human resources, but lags behind the EU average for

[99] Ibid.
[100] Aykut Göker, "Gelecek için Bilim ve Teknoloji Pazar Ekonomilerinde Teknoloji Öngörü Çalışmaları Genel Bakış", **TTGV**, 2002.

business innovation. The trend results for Norway are behind the EU average for eight of 11 indicators.

- **The Candidate Countries:** The Candidate countries perform favorably compared to the EU for tertiary education (with Bulgaria, Cyprus, Estonia and Lithuania equal to or above the EU mean), employment in high-tech manufacturing (with the Czech Republic, Hungary, Poland and Slovenia close to or above the EU mean), ICT expenditures (with the Czech Republic, Estonia, Hungary and Slovakia above the EU mean), and the stock of inward FDI (with the Czech Republic, Estonia, Hungary and Malta above the EU mean). The mean trend for the Candidate countries exceeds the EU mean trend for five of the ten comparable indicators, in particular for market and investment indicators.

- **Innovative regions in the EU**: At the regional level, the scoreboard introduces seven innovation indicators. These indicators provide coverage of *human resources*, *employment in high-technology sectors*, *and the creation of new knowledge through R&D and patents.* Due to the limited availability of other regional data these indicators are better at identifying regions with a strong research and innovation performance than regions with future potential, or regions that require diffusion-oriented policies. The regional scoreboard indicators are however a first start at underpinning regional policy with comparable data. The available regional data suggest a positive relation between a region's innovative performance and its economic performance. The top ten leading European regions are distributed across seven countries: Stockholm (S), Uusimaa (Suuralue) (FIN), Noord-Brabant (NL), Eastern region (UK), Pohjois-Suomi (FIN), Ile-de-France (F), Bayern (D), South-East region (UK) Comunidad de Madrid (E) and Baden-Wurttemberg (D). [101]

PART IV
ANALYSIS OF INNOVATION ON ENLARGEMENT COUNTRIES AND A CASE STUDY OF TURKEY

THE AIM OF THE CASE STUDY

In *innovation point of view*, whether Turkey is ready to join EU or not is still a question to be answered. The main idea of the research is to make a critical evaluation of innovativeness among European Union candidate countries in order to compare Turkey.

THE METHODOLOGY OF THE CASE STUDY

As it has been studied in the previous part of the thesis, enlargement countries have been included in the ***European Innovation Scoreboard 2002***. It is important to note that candidates have been mentioned in the Innovation Scoreboard 2002 as part of the process of "*enlargement, which will soon see the integration of several new Member States, will change the innovation profile of the European Union considerably."* In that sense, the methodology is based on the approach taken by European Union Innovation Scoreboard 2002 and the research contains Turkey's status with respect to innovativeness. Although the scoreboard prepared by EU contains quite a lot of information about candidate countries, it unfortunately presents some misleading points. Those are pointed out in the unrevealed facts of the case study.

THE LIMITATIONS OF THE CASE STUDY

EIS 2001 was being used in the early stages of the study. Later on, when The Commission of EU upgraded the scoreboard and published the 2002 version, a new data are used in the research. This difficulty is one of the limitations of the study. Besides that, The EIS complements the *Enterprise Policy Scoreboard* and other

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[101] European Commission, "Innovation Scoreboard Executive Summary", **"http://trendchart.cordis.lu/Scoreboard2002/executive_summary.html"**, 2003

benchmarking exercises of the European Commission. It mainly uses *Eurostat Data* or private data of sufficient reliability if official data is not available. Six indicators are drawn from the European Commission's Structural indicators. All indicators have been updated based on data availability as of September 15, 2002. Four indicators could not be updated due to delays in the execution of the third *Community Innovation Survey (CIS)*. As a result, the 2002 EIS does not provide trend results for these indicators.

4.1 EIS ON THE ENLARGEMENT COUNTRIES

All available evidence suggests wide disparities between the innovation frameworks and performance of candidate countries and those of the present Member States. Their economies tend to be highly polarised, with technologically advanced foreign owned companies forming islands of innovation among the larger numbers of technologically weak domestic firms. *The creation of new enterprises*, although rapid, does not seem to be giving rise to a strong dynamic of investment in high-growth, *knowledge-based firms*. Furthermore, while *public research institutions* are relatively strong, they are only orienting themselves slowly to the needs of the new market economies. Candidate country policy-makers acknowledge the long-term potential of innovation as a source of economic growth but often face other -- in the short term, more pressing -- priorities, as well as limited financial and human resources.

To maintain and eventually increase the innovation performance of the enlarged Union, and to maximise the advantages of an extended European innovation system both to its new and existing members, the obstacles to innovation in the candidate countries must be addressed immediately and decisively. This requires resolve by the candidate countries themselves to follow through general policy commitments with budget allocations and practical schemes to address failures of their innovation systems, plus a willingness among current Member States to support these efforts by sharing experience, tools and know-how.

The formulation and delivery of policy is hindered by a lack of appropriate procedures, and by conflict between the various lobbies participating in the policy-making process. In most candidate countries, responsibility for innovation policy has yet to be assigned to any one institution.[102]

4.1.1 Innovation Leaders among Candidate Countries

In the following, Table 4.1 identifies *the innovation leaders among the Candidate countries and gives the EU and Candidate countries means*. The table only includes the alternative indicators for all EPO patents, population with internet access, and inward FDI. None of the Candidate countries are above the EU mean for five of the 13 available indicators: high-tech services employment, business R&D, all EPO patents, high-tech USPTO patents, and internet access.

The Candidate countries perform favorably compared to the EU for the share of the working-age population with tertiary education (with Bulgaria, Cyprus, Estonia and Lithuania equal to or above the EU mean), the employment share for high-tech manufacturing (with the Czech Republic, Hungary, Poland and Slovenia close to or above the EU mean), ICT expenditures (with the Czech Republic, Estonia, Hungary and Latvia close to or above the EU mean), and the stock of inward FDI (with the Czech Republic, Estonia, Hungary and Malta above the EU mean).

For 3 indicators, Candidate countries are above the best performing EU member state: Lithuania for both working-age populations with tertiary education and high-tech venture capital, and Malta for sales of 'new to market' products.

Innovative capabilities in the Candidate countries are dominated by less than half of the countries, with 88% of the leading slots in Table 4.1 taken by six countries: Estonia (8), the Czech Republic and Slovenia (7 each), Lithuania and Hungary (5 each), and Malta (4). Latvia occurs twice, and Cyprus, Slovakia and Turkey once. Poland, Romania and Bulgaria are never among the top three performing Candidate countries.[103]

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[102] European Commission,"Innovation Policy in Europe 2002", **"http://trendchart.cordis.lu/Reports/html/chapter_five.html"**, 2003.
[103] European Commision, "Innovation Leaders among Candidate Countries", **"http://trendchart.cordis.lu/Scoreboard2002/html/candidate_countries/cc_2.1.html"**, 2003.

Table 4.1 Innovation Leaders among Candidate Countries

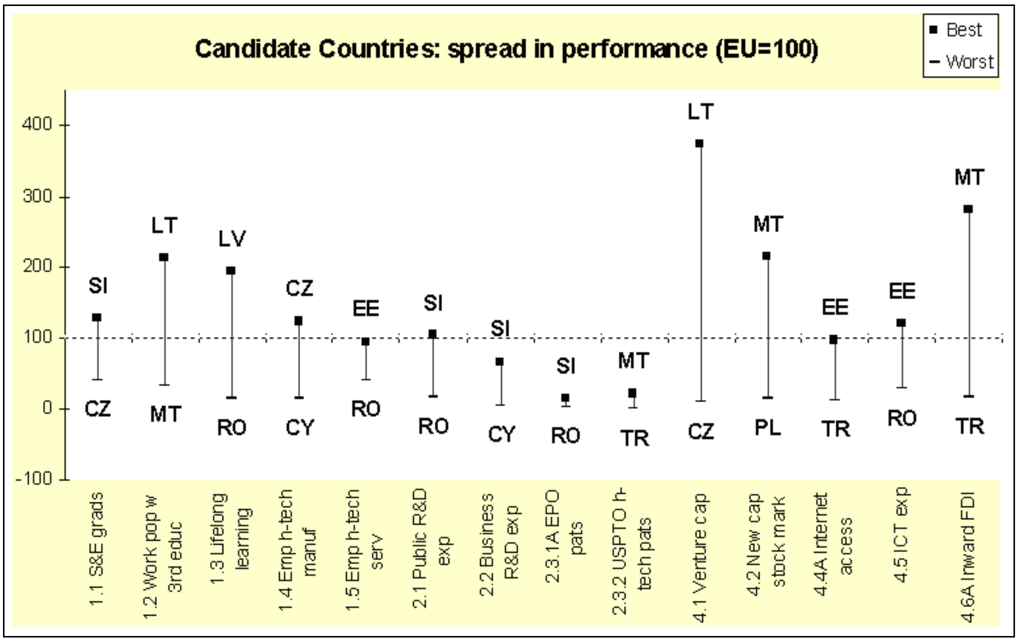
No	Indicator	EU Mean	CC Mean	CC leaders		
3.1	S&E graduates / 20 - 29 years	10.3	6.6	13.1 (SI)	9.4 (LT)	6.8 (EE)
3.2	Population with tertiary education	21.2	17.5	45.0 (LT)	29.4 (EE)	26.8 (CY)
3.3	Participation in life-long learning	8.5	5.4	16.3 (LV)	9.7 (MT)	5.3 (EE)
3.4	Employment in med./high-tech manufacturing	7.6	5.4	9.2 (CZ)	8.8 (HU)	8.7 (SI)
3.5	Employment in high-tech services	3.6	2.6	3.4 (EE)	3.2 (HU)	3.2 (CZ)
3.6	Public R&D / GDP	0.67	0.41	0.68 (SI)	0.54 (CZ)	0.53 (EE/LT/**TR**)
3.7	Business R&D / GDP	1.28	0.32	0.83 (SI)	0.81 (CZ)	0.45 (SK)
3.8/3.9	All EPO patents / population	152.7	7.1	20.6 (SI)	16.1 (HU)	12.1 (CZ)
3.10	High-tech USPTO patents /population	12.4	0.5	2.6 (MT)	0.6 (CZ)	0.5 (LT)
3.14	High-tech venture capital / GDP	0.24	0.27	0.90 (LT)	0.62 (LV)	0.15 (SI)
3.17	Home internet access / 100 population	31.4	14.8	30.1 (EE)	30.0 (SI)	25.4 (MT)
3.19	ICT expenditure / GDP	8.0	6.0	9.6 (EE)	9.5 (CZ)	8.9 (HU)
3.21	Inward FDI / GDP	30.3	31.3	84.7 (MT)	53.2 (EE)	43.4 (HU)

Source: European Innovation Scoreboard, “Innovation Leaders among Candidate Countries”, **“http://trendchart.cordis.lu/Scoreboard2002/html/candidate_countries/cc_2.1.html”**, 2003.

According to the table, CIS indicators have not been updated for the EU and are therefore not included in this table. Besides, the weighted mean based on summing the numerator and denominator across all EU countries (for indicator the EU mean is an unweighted mean). The Candidate Countries’ mean is being calculated from the unweighted average for countries for which data are available. Insufficient data are available for calculating weighted means.

4.1.2 Spread in Performance Candidate Countries

Table 4.2 Candidate Countries: Spread in Performance (EU=100)



Source: European Innovation Scoreboard, “Candidate Countries: Spread in Performance”, **“http://trendchart.cordis.lu/scoreboard2002/img/cc.gif”**, 2003.

In Table 4.2, the best and worst candidate countries with respect to European Union average are presented for 14 indicators. This table is useful to evaluate the *weakness* of each country as well as the general situation of candidates. In the following indicators: *S&E graduates*, *Work population with tertiary education*, *Life long learning, Venture capital, New capital stock markets*, *ICT expenditures* and *Inward of FDI* the average values of candidate countries are not far from European average. Therefore these countries more or less seem ready to EU. However, the rest of the indicators show that substantial progress is needed. With respect to country base, it is seen that ***Romania*** has five worst indicators and ***Turkey*** follows it with three.

4.1.3 Trends in Innovation Performance per change

Table 4.3 Trends in Innovation Performance per change (% change)

No	Indicator	EU Mean	CC Mean	CC leaders		CC decreases	
3.1	S&E graduates / 20 - 29 years	13.7	14.3	53.2 (LT)	38.2 (EE)	-14.4 (HU)	--
3.2	Population with tertiary education	17.9	7.3	17.8 (BG)	14.2 (RO)	-1.1 (SI)	-0.1 (EE)
3.3	Participation in life-long learning	21.4	2.9	22.2 (RO)	7.9 (LV)	-7.5 (LT)	-7.0 (EE)
3.4	Employment in med/high-tech manufacturing	-2.0	10.2	105.7 (LV)	20.0 (EE)	-21.4 (RO)	-15.4 (LT)
3.5	Employment in high-tech services	18.3	10.4	30.4 (SI)	24.3 (CY)	-11.9 (LT)	-8.6 (RO)
3.6	Public R&D / GDP	-2.0	3.7	57.8 **(TR)**	26.0 (CZ)	-34.1 (RO)	-27.0 (SK)
3.7	Business R&D / GDP	7.0	8.1	85.8 **(TR)**	83.7 (LV)	-43.6 (RO)	-37.4 (BG)
3.17	Home internet access / 100 population	155.3	148.7	255.2 (MT)	226.1 (BG)	--	--
3.19	ICT expenditure / GDP	14.8	26.2	40.5 (PL)	38.9 (SK)	--	--
3.21	Inward FDI / GDP	99.3	79.3	195.1 (SK)	180.9 (BG)	-3.3 (CY)	--

Source: European Innovation Scoreboard, "Trends in Innovation Performance (% change) in Candidate Countries", **"http://trendchart.cordis.lu/Scoreboard2002/html/candidate_countries/cc_2.2.html"**, 2003.

According to the above table, CIS indicators have not been updated for the EU and are therefore not included in this table. The weighted mean is based on summing the numerator and denominator across all EU countries (for indicator 3.1 the EU mean is an unweighted mean). For the Candidate Countries Analysis, the unweighted average is for countries for which data are available. Insufficient data are available for calculating weighted means.

Trend results for the Candidate countries are summarized in Table 4.3. Data are available for only ten indicators, although for new indicators such as S&E graduates and lifelong learning, data are only available for six or fewer countries.

The mean trend for the Candidate countries *exceeds* the EU mean trend for five of the ten comparable indicators. However, a striking feature of the trend results for these countries is that there are many negative values for the human resources indicators and for R&D, due in part to deep, structural changes in several of the economies.

The trend averages are much higher for the market and investment indicators in group four, where only ***Cyprus*** for *inward FDI* has a negative trend. Due to the prevalence of negative trends, Table 4.2 gives both the two leading countries and the two countries with the largest negative trends. For the indicators in group one and two, the means for the Candidate countries are often relatively low, based on the average between large increases in some countries and large decreases in others.

Almost all Candidate countries are *trend leader* for at least one indicator, with ***Bulgaria*** and ***Latvia*** leading for 3 indicators and ***Estonia***, ***Romania***, ***Slovakia*** and ***Turkey*** for 2 indicators. ***Bulgaria*** is leading for population with tertiary education, internet access and inward FDI, while ***Latvia*** is leading for participation in life-long learning, employment in medium/high-tech manufacturing and business R&D. Although ***Romania*** is the most affected by decreases in both R&D and the employment indicators, it is improving at an above average rate for two education indicators. ***Estonia*** is leading for S&E graduates and employment in medium/high-tech manufacturing, Slovakia is leading for ICT expenditures and inward FDI, and ***Turkey*** is leading for both R&D indicators.

As a note of caution, several of these leading trends for individual countries are derived from very low initial values, so that even after rapid growth the trend leaders are often below the indicator average for the Candidate countries.[104]

[104] European Innovation Scoreboard, "Relative Strengths and Weaknesses of Candidate Countries", **"http://trendchart.cordis.lu/Scoreboard2002/html/candidate_countries/cc_2.2.html"**, 2003.

4.1.4 Relative Strengths and Weaknesses of Candidate Countries

In the following table, major relative strengths and weaknesses of candidate countries are given.

Table 4.4 Relative Strengths and Weaknesses of Candidate Countries

Country	Major relative strengths	Major relative weaknesses
Bulgaria	Trend for home internet access and inward FDI	Current business R&D, EPO patents and home internet access, trend for business R&D
Cyprus	Current tertiary education and home internet access	Current medium/hi-tech manufacturing employment and business R&D; trend for inward FDI
Czech Republic	Current medium/hi-tech manufacturing employment, business R&D and EPO patents	Current education
Estonia	Current tertiary education, home internet access and inward FDI	Trend for business R&D
Hungary	Current medium/hi-tech manufacturing employment and EPO patents; trend for home internet access	Current education; trend for S&E graduates and inward FDI
Lithuania	Current education; trend for S&E graduates and home internet access	Current business R&D, EPO patents and home internet access
Latvia	Current life-long learning; trend for medium/hi-tech manufacturing employment and business R&D	Current medium or high-tech manufacturing employment, EPO patents and home internet access; trend for home internet access
Malta	Current life-long learning, home internet access and inward FDI; trend for home internet access	Current tertiary education and ICT expenditures
Poland	Current medium/hi-tech manufacturing employment	Current tertiary education, EPO patents and home internet access; trend for home internet access
Romania	Trend for life-long learning	Current life-long learning, public R&D and EPO patents
Slovenia	Current S&E graduates, business R&D, EPO patents and home internet access	Current life-long learning and inward FDI ; trend for inward FDI
Slovakia	Current medium/hi-tech manufacturing employment & business R&D; trend for inward FDI	Current tertiary education and public R&D; trend for home internet access
Turkey	Current public R&D; trend for R&D	Current medium/hi-tech manufacturing employment, home internet access and inward FDI

Source: European Innovation Scoreboard, “Relative Strengths and Weaknesses of Candidate Countries”, **“http://trendchart.cordis.lu/Scoreboard2002/html/candidate_countries/cc_2.2.html”**, 2003.

Table 4.4 summarizes the relative strengths and weaknesses of each Candidate country. Only those indicators for which current levels are available for at least 10 countries are considered. The results are limited to a maximum of four current indicators or trends that are at least 20% (above or below) the CC mean. Some countries are weak in several related indicators, such as the three education or two R&D indicators. These are treated as a single indicator.

All countries have some strength, although these are limited to trends for the less innovative countries of ***Bulgaria*** and ***Romania***. The strengths of the more innovative Candidate countries (***Czech Republic, Estonia, Hungary, Lithuania, Malta*** and ***Slovenia***) are dominated by current conditions, except for ***Lithuania***, which has a strong trend for both *S&E graduates* and *internet access*. For some countries, an indicator can be both a current and trend strength: *S&E graduates* for ***Lithuania***, *internet access* for ***Malta***, and *business R&D* for ***Turkey***. Both high-tech services employment and ICT expenditures are of no strength for any country.

The relative weaknesses are evenly spread over indicator categories one, two and four. Weaknesses for human resources and knowledge creation are mostly current weaknesses, except for a weak trend for S&E graduates in ***Hungary*** and for business R&D for ***Turkey***, ***Bulgaria*** and ***Estonia***. Innovation finance, output and markets weaknesses are both of a current and trend nature: internet access is a current weakness for ***Bulgaria*** and ***Lithuania***, a trend weakness for ***Slovakia***, and both for ***Latvia*** and ***Poland***. The stock of inward FDI is a current weakness for ***Turkey***, a trend weakness for ***Cyprus*** and ***Hungary***, and both for ***Slovenia***.[105]

4.2 UNREVEALED FACTS ABOUT EIS

Although the scoreboard prepared by EU contains quite a lot of information about Candidate Countries, it unfortunately presents some misleading points. This can be seen by a careful examination of the scoreboard yields that the values in tables are per unitized by, dividing the values to population, GDP, etc. This method does not

[105] Ibid.

show the strength of the large countries with comparatively high populations and high GDPs like ***Turkey***. The following table illustrates the actual size of the Candidate Countries and the effect of Turkey.

4.2.1 GDP of Candidate Countries

Table 4.5 % GDP PPS

Countries	GDP, 2000 Million PPS[106]	% GDP PPS / EU GDP	% GDP PPS / CC Total PPS	Ranking in GDPs
Bulgaria	47.250	0,5517	3,6607	7
Cyprus	11.878	0,1387	0,9202	12
Czech Republic	130.467	1,5233	10,1078	3
Estonia	12.434	0,1452	0,9633	11
Hungary	114.638	1,3385	8,8815	5
Lithuania	28.257	0,3299	2,1892	9
Latvia	16.552	0,1933	1,2824	10
Malta	-	-	-	-
Poland	339.429	3,9632	26,2970	2
Romania	118.124	1,3792	9,1516	4
Slovenia	30.213	0,3528	2,3407	8
Slovakia	56.035	0,6543	4,3413	6
Turkey	385.473	4,5008	29,8643	**1**
Total Candidates	**1.290.750**			
EU Total	**8.564.503**			

In the above table, all candidate countries GDP per million PPS is shown in the year 2000. Among the candidates, the country that has the highest % GDP per million is ***Turkey***. ***Poland*** is very close to Turkey, which has the second highest GDP of 13 candidates. Therefore Turkey, with largest GDP among CC Countries shows great potential for the EU. Turkey's GDP is approximately 5% of EU total.

In the below table, the actual population of the Candidate Countries is illustrated.

[106] Axel Behrens, "Regional Gross Domestic Product in Candidate Countries 2000", **Eurostat**, 2003.

4.2.2 Population of Candidate Countries

Table 4.6 Candidate Countries Population

	Population *1000 [107]	**% Population / EU Total**	**% Population / CC Total**	**Ranking in Population**
Bulgaria	7.900	0,0210	0,0457	6
Cyprus	760	0,0020	0,0044	12
Czech Republic	10.200	0,0271	0,0590	4
Estonia	1.400	0,0037	0,0081	11
Hungary	10.200	0,0271	0,0590	5
Lithuania	3.500	0,0093	0,0202	8
Latvia	2.400	0,0064	0,0139	9
Malta	400	0,0011	0,0023	13
Poland	38.600	0,1024	0,2233	2
Romania	22.400	0,0594	0,1296	3
Slovenia	1.900	0,0050	0,0110	10
Slovakia	5.400	0,0143	0,0312	7
Turkey	67.800	0,1798	0,3922	**1**
Total Candidates	**172.860**			
EU Total	**377.000**			

In the above table, the populations of all candidate countries are shown and ***Turkey*** has the highest population among all of them. According to this information, the results of the European Union Scoreboard do not accurately reflect the strength of a large country such as Turkey because they are all divided to per population. Therefore, the higher the population numbers, the lower the grade of the candidate country.

[107] Eurostat, “People in Europe”, Candidate Countries Population, **Eurostat Yearbook 2002,** 2002.

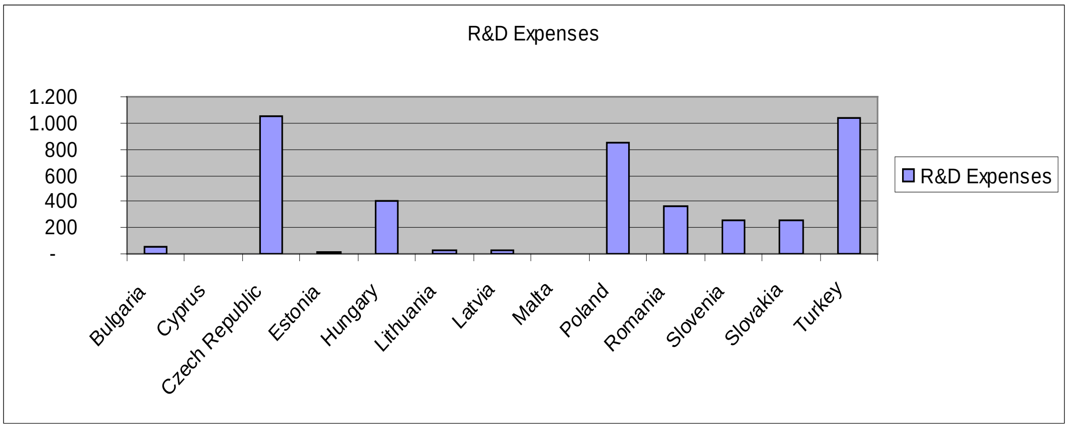
4.2.3 Business Expenditure on R&D

Accordingly, the following table illustrates business expenditure on R&D among all Candidate Countries. As is seen, ***Turkey*** has the *highest trend* for business expenditure on R&D. When business expenditures on R&D of candidate countries are ranked, ***Czech Republic*** has the highest overall ranking. Turkey follows it with the second ranking, which is positive situation for Turkey in regards to innovativeness.

Table 4.7 Business Expenditure on R&D (% of GDP)

CC Countries	Level	Trend base	Trend base years	Trend	Trend ranking	GDP 2000, million PPS	R&D Expense	% R&D /Total CC	Ranking
Bulgaria	0,11	0,2	96-98	-37,4	10	47.250	53	0,0122	8
Cyprus	0,05	-	-	-	-	11.878	6	0,0014	12
Czech Rep.	0,81	0,7	96-98	12,9	5	130.467	1.057	0,2433	1
Estonia	0,15	0,1	98	26,0	4	12.434	19	0,0044	11
Hungary	0,36	0,3	96-98	26,4	3	114.638	407	0,0937	4
Lithuania	0,07	0,1	96-98	-30,4	9	28.257	21	0,0047	10
Latvia	0,20	0,1	96-98	83,7	2	16.552	32	0,0075	9
Malta	-	-	-	-	-	-	-	-	-
Poland	0,25	0,3	96-98	-14,0	7	339.429	849	0,1953	3
Romania	0,30	0,5	95-97	-43,6	11	118.124	358	0,0823	5
Slovenia	0,83	0,8	95-97	9,7	6	30.213	251	0,0578	7
Slovakia	0,45	0,6	96-98	-30,3	8	56.035	252	0,0580	6
Turkey	0,27	0,1	96-98	85,8	1	385.473	1.041	0,2395	2
Total CC						**1.290.750**	**4.346**		
EU	**1,28**	**1,2**	**97-99**	**5,4**		**8.564.503**	**109.203**		

Figure 4.1 Business Expenditure on R&D



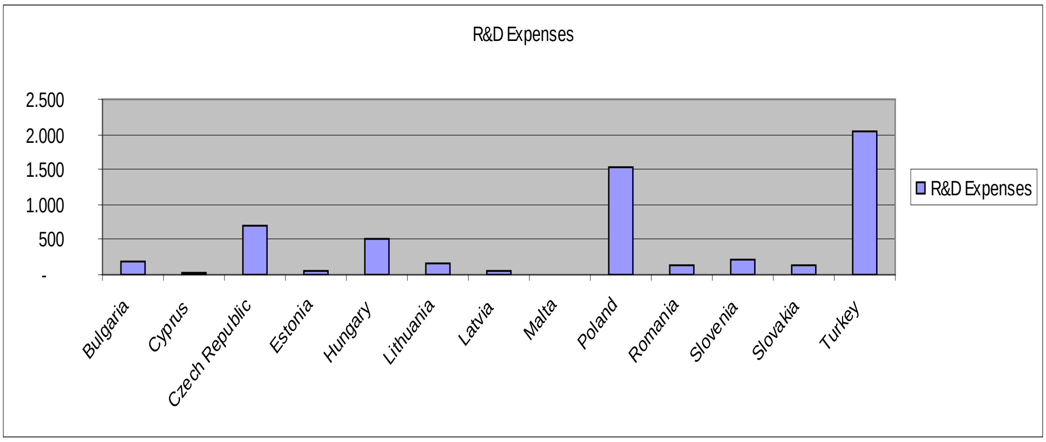
4.2.4 Public Expenditures on R&D

The following table 4.8 illustrates Public R&D expenditures among all Candidate Countries. As is seen, ***Turkey*** is the *leader* both in trend ranking R&D expenses. After Turkey, ***Poland*** and ***Czech Republic*** follow accordingly.

Table 4.8 Public Expenditures on R&D (GERD-BERD) (% of GDP)

CC Countries	Level	Trend base	Trend base years	Trend	Trend ranking	GDP 2000, million PPS	R&D Expense	% R&D / Total CC	Ranking
Bulgaria	0,41	0,4	96-98	11,5	4	47.250	193	0,0149	6
Cyprus	0,20	-	-	-	-	11.878	24	0,0018	12
Czech Rep.	0,54	0,4	96-98	26,0	2	130.467	706	0,0547	3
Estonia	0,53	0,5	96-98	-2,8	7	12.434	65	0,0051	10
Hungary	0,45	0,4	96-98	10,5	5	114.638	512	0,0396	4
Lithuania	0,53	0,4	96-98	17,9	3	28.257	149	0,0116	7
Latvia	0,29	0,3	96-98	-14,6	9	16.552	48	0,0037	11
Malta	-	-	-	-	-	-	-	0,0000	13
Poland	0,45	0,4	96-98	5,9	6	339.429	1.527	0,1183	2
Romania	0,10	0,2	95-97	-34,1	11	118.124	123	0,0095	9
Slovenia	0,68	0,8	95-97	-10,5	8	30.213	206	0,0159	5
Slovakia	0,24	0,3	96-98	-27,0	10	56.035	134	0,0104	8
Turkey	0,53	0,3	96-98	57,8	1	385.473	2.043	0,1583	1
Total CC						**1.290.750**	**5.730**		
EU	0,67	0,7	97-99	-2,0		**8.564.503**	**57.100**		

Figure 4.2 Public Expenditures on R&D



4.3 TURKEY’S CURRENT PERFORMANCE

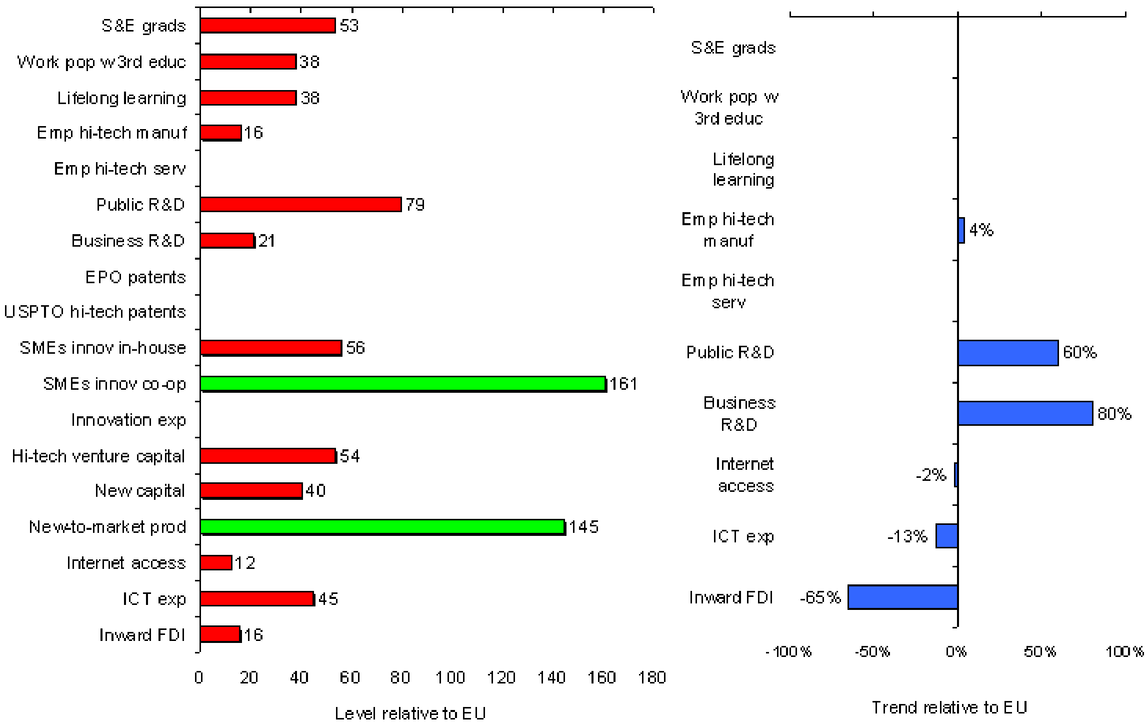
As has been mentioned above, European Innovation Scoreboard 2002 covers ***Turkey***. Therefore, this part of the thesis will be focused on Turkey. In the following figures EU and CC countries will be compared for 21 indicators which in tun will be evaluated. In Table 4.9, Turkey’s current performance indicators are presented together with CC and EU mean values, and the percentage values of Turkish levels. The trends are also included in this table.

Table 4.9 Turkey’s Current Performance according to European Innovation Scoreboard 2002

TURKEY	Level	CC Mean	Normalised to CC	EU Mean	Normalised to EU	Trend	CC Trend	Relative to CC	EU Trend	Relative to EU
New S&E grads	5,5	6,6	83,5	10,3	53,3	-	14,3	-	13,7	-
Pop with 3rd education	8,0	17,5	45,7	21,2	37,7	-	7,3	-	17,9	-
Life-long learning	3,2	5,4	59,1	8,5	37,8	-	2,9	-	21,4	-
Empl. med/hi-tech manufacturing	1,2	5,4	22,0	7,6	15,7	2,0	10,2	-8,2	-2,1	4,1
Empl. Hi-tech services	-	2,6		3,6	-	-	10,4	-	18,3	-
Public R&D	0,53	0,4	128,7	0,7	79,5	57,8	3,7	54,1	-2,0	59,8
Business R&D	0,27	0,3	84,1	1,3	21,2	85,8	8,1	77,7	5,4	80,4
EPO hi-tech patents	0,1	1,4	4,3	27,8	0,2	-	-	-	-	-
EPO patents	-	7,1	-	152,7	-	-	-	-	-	-
USPTO hi-tech patents / pop	0,0	0,5	3,2	12,4	0,1	-	-	-	43,9	-
SMEs innov. in-house	24,6	24,2	101,7	44,0	55,9	-	-	-	-	-
SMEs innov. co-op	18,0	12,0	150,4	11,2	160,7	-	-	-	-	-
Innovation exp	-	3,5		3,7	-	-	-	-	-	-
Hi-tech venture capital	0,130	0,3	47,8	0,2	53,7	-	-	-	-	-
New capital	0,7	1,5	45,2	1,7	40,1	-	-	-	-	-
New-to-market prod	9,4	17,7	53,0	6,5	144,6	-	-	-	-	-
Home internet access/ household	-	8,4	-	37,7	-	-	-	-	-	-
Internet access / pop	3,8	14,8	25,7	31,4	12,1	153,3	148,7	4,7	155,3	-2,0
ICT expenditures	3,6	6,1	58,7	8,0	45,0	1,9	26,2	-24,3	14,8	-12,9
Manuf. hi-tech value-added share	6,6	14,4	45,4	10,1	64,9	37,0	18,9	18,2	23,2	13,9
Inward FDI	4,7	31,3	15,0	30,3	15,5	34,3	79,3	-45,0	99,3	-65,1

Source: European Innovation Scoreboard, “Turkey’s Current Performance According to European Innovation Scoreboard 2002”,
“http://trendchart.cordis.lu/Scoreboard2002/html/candidate_countries/data/data_turkey.xls”

Figure 4.3 Turkey's Current Performance According to European Innovation Scoreboard 2002



Source: European Innovation Scoreboard, "Turkey's Current Performance According to European Innovation Scoreboard 2002",
"http://trendchart.cordis.lu/Scoreboard2002/html/candidate_countries/current_performance/current_performance_turkey.html"

As is seen in the above figures, *Turkey's SMEs innovating in house* and *new to market production* are *above* the European Union mean. *Public and Business R&D* in ***Turkey*** has good grades among all the indicators.

It is understood that the 21st century will be an era of innovative changes in technologies. States, societies and companies must have intellectual properties relevant to high technology topics. In Turkey, *"new product development process"* is not a very old, nor is *"new technology development"* very widespread yet. Unfortunately, Turkey is still in a position of importing high technologies from outside. There is currently not a large group of innovators in Turkey but there are some positive improvements with respect to the new product development processes and innovative activities. [108]

There is no doubt that these days the speed of change is very high and that resources are limited. Therefore innovation can not be achieved by only R&D studies. In this respect, *technology transfer, FDI*, *strategic alliances, mergers & acquisitions* and *joint ventures* are means of gaining knowledge the marking methods of new technology. Since Turkey has relatively a long history an integrated free market economy, Turkish companies are familiar with the above methods. Perhaps, this would also prove to be a major advantage for ***Turkey*** with respect to European Union integration.

According to Akgüngör, the *technological innovativeness* of ***Turkey*** is highly concentrated on the mining cluster, followed by chemical and vehicle manufacturing clusters. On the other hand, *process innovations* that facilitate restructuring through introducing new resource saving production techniques are highest in the food and agriculture cluster. Besides the above, *product innovations* in chemical and textile and home accessories clusters are higher than product innovations in the food industry.

Cooperation with external sources (customers and suppliers) is particularly high in the vehicle-manufacturing cluster. On the other hand, cooperation with the universities and technoparks is relatively higher in the leather cluster. Akgüngör stated that perhaps due to its close interaction with universities and technoparks, the leather cluster has highest percentage of firms with patent application. The leather cluster has a higher share than most of other clusters with respect to new and modified products as percentage of total sales as well in ***Turkey***.[109] In addition, the presence of innovativeness as a common value in networks means that in the coming

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[108] Murat Ferman, Alp Yörük, "SMEs and Digital Opportunities", paper presented **1st Annual SME 2002 Conference Proceedings**, Eastern Mediterranean University, North Cyprus/Turkey, 2002.
[109] Ibid., Akgüngör, "Innovativeness Within Industrial Relationships: A Case Study of Industry Clusters in Turkey".

decade, more activities related to knowledge transfer are likely to be managed through activities between the firms within market networks. [110]

Karaata stated that, traditionally, ***Turkey*** has been concentrating its effort and investing in specific sectors; in which industrial firms comprehend they possess a comparative advantage such as in *textile manufacturing*, *construction*, *food*. One of the fundamental questions to be asked with this outcome should be whether this assumed advantage is sustainable or not, and further, whether the process must integrate itself particularly with higher value added products and processes.[111]

4.4 SWOT ANALYSIS OF TURKEY IN TERMS OF INNOVATION

As is known, SWOT Analysis presents the *strengths*, *weaknesses*, *opportunities* and *threats* of a certain topic. The objective of this part of the thesis is to present the SWOT Analysis of the Turkish innovative structure. However, innovation policy is also relevant to *economical*, *political* and *social* developments of the country and region that it belongs to. In the following SWOT Analysis these concepts are also covered.

Strengths:

- **Having secular state with established democracy:** Turkey is a democratic state and has had secularism since 1923. The system of governance in Turkey is suitable for innovation. This also facilitates Turkey relationship with international organizations in which innovative states occupy the major part.

- **Long history of integration with world free market economy:** Turkey has had a free market economy since 1950s. Turkey has also had a very challenging privatization program since 1980. In accordance with

[110] Sedef Akgüngör, R. Funda Barbaros, Neşe Kumral, "Vertical Market Networks and Innovative Culture: An Empirical Examination of the Turkish Fruit and Vegetable Industry", Harlan E. Spotts H. Lee Meadow Scott M. Smith (eds.) **World Marketing Congress - On Global Marketing Issues at the Turn of Millennium**, Volume X, June 2001, ISBN: 0-939783-03-7.
[111] Selçuk Karaata, "A Literature Review on SMEs", **Innovation and Financial Markets**, 2003.

globalization, Turkey has integrated with the world by strategic alliances, joint ventures, mergers & acquisitions, etc. This means innovation has been boosted through various strategic alliances.

- **Comparatively large economy:** Turkey has a comparatively large economy. This provides a larger inner market for innovative new products. It is also commonly accepted that when the economy grows, the budget for innovation increases.

- **Geopolitical position (being close to energy sources):** Most of the energy reserves are in countries neighboring Turkey. According to *International Energy Agency* predictions, in 10 years, the share of the Middle East in the world energy market will exceed 70 % of the whole world market. This means economical expansion for the region. There will be an opportunity for Turkey to do innovative research in energy related fields.[112] This thesis is being written during the Iraq crisis and the period of uncertainty, political, economic, etc., that accompanies it. It is too early to know, whether the changes will be positive for Turkey or not. This reflects the fact that Turkey's *'geopolitical position'* is not only an opportunity but also a threat.

- **Young population:** Turkey's population is the highest among all the candidate countries, and its population is very young. It is known that creativity and innovation are mainly associated with the young generation. This is one of the major strength of Turkey. There is no doubt that, firms would prefer to make investments in a place with youthful demographics. The young population of Turkey is an advantage for the country if they are educated well.

- **Having state R&D institutions and incentives:** According to European Innovation Scoreboard 2002, Turkey's public R&D performance is better than most of the candidate countries. This puts Turkey in when compared

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[112] R. Nejat Tuncay at al, "İleri Enerji Teknolojileri Raporu", **TÜBİTAK**, 2001.

with other candidate countries as far as innovation compatibility is concerned.

- **Having R&D departments in private enterprises:** In Turkey, private enterprises support innovation by opening R&D departments and forming new product development processes. In R&D departments of companies such as ***Arçelik, Vestel, Netaş, Tofaş*** and ***Şişecam*** Turkish engineers have developed new innovative products. In this respect, the R&D departments of Turkey's private companies have longer experience than most of the candidate countries in developing *prototypes* for an open market economy.

- **Having multinational brands:** As has been mentioned above, Turkey has a long history of *integration* with the world's free market economy. In this respect, Turkey has *created* some multinational brands that are delivered all over the world. Turkish firm owners have proven they have the entrepreneurial skills to develop new brands. ***Mavi jeans*** and ***Zeki Triko*** are examples of innovative brand-establishing processes.

- **Being a Mediterranean Country and having good holiday resorts:** Being innovative is a very complex issue. It also covers the popularity of the country. Natural and historical values and a good climate are part of the popularity. It is known that most international conferences are held in holiday resorts. If a country is attractive to firms doing foreign research, these researches would natural be willing to take part in joint research projects. As a *Mediterranean* country, some of the research institutions in Turkey are located near to the traditional Mediterranean vacation region which also extends throughout the south of Turkey. This is plus for the country as most of the candidate countries are in the cold climate belt.

Weaknesses:

- **Wrong education attitude:** The Turkish education system has some serious deficiencies. Creativity and analytical thinking are generally not encouraged.

Quite often texts are *memorized* instead of being understood. The university entry examination system formats students to select correct answer among pre-defined choices. How could a candidate be creative, if he/she get use to find the correct answer among what is offered to him/her. Instead knowledge should be analyzed, discussed, grasped and innovative ideas should build up

- **High increase in population and high interior immigration:** As has been mentioned earlier, Turkey is a highly populated country and the birth ratio is the highest among candidate countries. In addition, immigration from small towns and villages to big cities and from one region to other is still going on. This immigration within the country has resulted in much of the population faced with basic survival talks such as finding a place to live in or a job to survive. Thus, R&D becomes a *secondary* objective. According to Saral and Çelebi knowledge and technology are concentrated in the western part of Turkey.[113] The cultural difference between the east and west of the country also presents major problems.

- **Lack of financial resources:** Although Turkey has the highest GDP among all candidate countries the per capita income is lowest. There is a lack of financial resources for innovation. The main concern here is that there are more vital concerns taking the country's time than innovation. Turkey is *not* a rich country and has presently a large exterior debt to the IMF.

- **The insufficient infrastructure (transportation, communication, energy, etc):** Turkey has an insufficient infrastructure, especially in *transportation, communication* and *energy fields*. Transportation is mainly based upon road traffic, of which the cost per capita, per km is much higher than that of railways. It is also vulnerable to weather conditions. Additionally delays occur because of traffic congestion in big cities. There is no doubt that these conditions affect innovation adversely.

[113] Güldem Saral, Deniz Çelebi, "The Innovative Capacity and Learning Capability of Turkish Regions", **Erc/Metu International Conference in Economics VI**, September 11-14, Ankara, 2002,

- **Low rate of FDI because of the geopolitical position:** As Turkey has often been economically unstable in the last 10 years, firms do not prefer to come to the country and make investments. Foreign Direct Investment is a very important issue in *technology transfer* and *innovation*. If firms open FDI in a country, this automatically yields more money and investments and employees get an experience by learning the knowledge of technology necessary to produce goods.

- **Generally having follower strategy, instead of being a leader:** In spite of supports and incentives provided by ***TİDEB/TÜBİTAK*** and other governmental institutions, many companies seem to prefer adopting the follower strategy. Until recently, Turkey does not seem to have a strategy to become a leader in innovation. However it should be noted that a new program recently started by ***TÜBİTAK*** called ***"Vision 2023"***, aims to raise Turkey to become a *leader nation* in the world, by the year 2023, which is the centenary of the foundation of the republic.[114]

- **Lack of stability of economical, social and political situations:** Recent history shows that Turkey's political and social stability is *weak.* There have been three military coup d'état since 1960. As far as international companies are concerned, lack of stability discourages investment. The EU Scoreboard figures show that *FDI* in Turkey is much weaker than other candidate countries.

- **Small and very traditional family companies and their negative attitude to innovation:** There are many traditional firms in Turkey, which is to say companies run by the family, which are not generally open to innovation. *Modernization* will gradually diminish these attitudes.

[114] Bilim ve Teknolojileri Stratejileri, "Vizyon 2023", **"http://vizyon2023.tubitak.gov.tr/"**, 2003.

<u>Opportunities:</u>

- **Rapid change in technology**: There is an opportunity when emerging technologies are *adopted* or *develop* faster than the traditional technology leaders. It is possible to become leader in some of new technologies. Turkey has a chance to do this by using its young generation effectively. As has been mentioned before, Turkey has a very young population. This is an opportunity for Turkey to focus on emerging technologies by using the young generation efficiently and effectively.

- **Integration with European Union on innovation projects:** Turkey is a candidate country and the EU provides many opportunities to candidate countries in such a position. If the right attitude would be adopted and the right policy implemented, it is possible to gain a share of the high technology industry by taking part of the EU *FP6 innovation projects*. It should be reminded that other enlargement countries might also do so. According to ***Gök***, Turkey should increase its technological strength both through its own policies and by collaborating with EU countries. The collaboration projects enable technology transfer between the partners. The EUREKA project is the first step between Turkish industry and EU.[115]

- **Possibility of becoming an innovation center for Asian-Turkish states:** Turkey's geopolitical position offers some advantages when compared with other candidate countries. In addition to being near energy sources, as mentioned above, there are natural gas and petroleum rich Turkish speaking West-Asia states. These states are not only rich with reserves but also have an educational workforce. Turkey's long free market tradition might provide some assistance to these countries. If collaboration on R&D is established for innovative products within the country, there is a good possibility of success.

Threats:

The above mentioned arguments about opportunities could turn out to be threats if those opportunities are missed or mismanaged.

- **Political unrest of the region (risk of the war, etc…):** As a state, Turkey can not focus on innovation because of politically *unrest* internally and externally. There is a risk of war in the southeastern borders of Turkey and this effects the country's political stability, which in turn effects economic questions such as productivity and innovation.

- **Unexpected change in technology:** Technology is changing and new technologies are developing every minute. An unexpected change in technology that Turkey *can not adapt* to may bring some problems. Turkey will fall behind more developed countries unless Turkey carefully plans and implements a correct R&D policy.

- **Automation trend (reduce the advantage of cheap labor force):** Technological innovations in *communication, reduction in the transportation costs,* and *revolutions in information* lies in the heart of the globalization.[116] Before globalization and Information Era, a labor force was an important factor for determining the productivity of the economy. Since automation and robotics trends have often replaced the labor force, some states like Turkey, which have cheap labor force will loose their advantage. Indeed, without life long learning opportunities, this advantage quickly becomes a liability.

- **International regulations and standards:** Introduction of unexpected international regulations and standards can be a threat for Turkey if the country finds them difficult to comply to.

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[115] Aslıgül Gök, "The European Union Research and Technological Development Policies", **Master Thesis**, November 1998, p.69.
[116] Aslı Tuncay, "The Effects of Internet Negotiations in Management", **International Management Sciences Conference Proceedings**, Istanbul Technical University, 2001.

- **Monopolization:** In this highly competitive free market economy some international companies are monopolized to such an extent as to stifle Turkish innovators. Monopolization of international companies and their negative attitude toward innovation in Turkey is a risk for the economy.

As we all know, the world is a highly competitive environment. There are many companies and industries, but the ones, which have a working policy of innovation, produce better products/processes with lower cost are going to be successful more than their competitors. This situation is the same for the United States or any country in the world market. Some established industries in Turkey have lost their economic momentum because of the introduction of new technologies. Since maintaining competitiveness takes time and money, Turkey must do all it can to encourage and facilitate innovation.

CONCLUSION AND FURTHER RESEARCH

This thesis concerns itself with the innovativeness of Turkey with respect to European integration. The initial parts of the thesis deals with the various definitions and approaches of innovation. Among them the following definition, which is adopted by EU seems the most appropriate:

In the new world order, innovation policy should be understood as a set of policy actions to raise the quantity and efficiency of innovation activities, whereby innovative activities refer to the creation, adaptation and adoption of new or improved products, processes or services.

One conclusion about these discussions is that the link between a prosperous society and innovation is not clearly formulated. Although, this is not the objective of this thesis, some effort has been devoted to establish this link. The followings are a summary of these conclusions.

- *Research and Technological Development* expenses should yield a competitive market value. It should at least be known what percent of R&D expenditures become a product, and what would be the value added because of the new product.

- There are various R&D areas; some areas produce higher added values than others do. Some has a shorter idea to product time. Therefore it is not wise to only compare R&D budgets. R&D expenses should be multiplied with research area code.

- The number of *patents* a country creates is a good sign. However it is arguable what is the ratio of commercially useful patents to those that can not be used.

The European Union has conducted a comprehensive investigation of the innovativeness of their member states and published the report in 2001 as the

“European Innovation Scoreboard 2001” heading. In the 2002 version of the same report candidate countries are also taken into account. The scoreboard gives an analysis of innovation in enlargement countries. According to the Innovation Scoreboard, the candidate countries perform favorably compared to the EU for the share of the working-age population with tertiary education *(with Bulgaria, Cyprus, Estonia and Lithuania equal to or above the EU mean)*, the employment share for high-tech manufacturing *(with the Czech Republic, Hungary, Poland and Slovenia close to or above the EU mean)*, ICT expenditures *(with the Czech Republic, Estonia, Hungary and Latvia close to or above the EU mean)*, and the stock of inward FDI *(with the Czech Republic, Estonia, Hungary and Malta above the EU mean).*

For 3 indicators, candidate countries are above the best performing EU member state: Lithuania for both working-age populations with tertiary education and high-tech venture capital, and Malta for sales of 'new to market' products. The innovative capabilities in the Candidate countries are dominated by less than half of the countries, with 88% of the leading slots taken by six countries: Estonia (8), the Czech Republic and Slovenia (7 each), Lithuania and Hungary (5 each), and Malta (4). Latvia occurs twice, and Cyprus, Slovakia and *Turkey* once. Poland, Romania and Bulgaria are never among the top three performing Candidate countries.

This thesis point outs some misleading facts of the Innovation Scoreboard 2002. The comparison of the *GDPs, populations, business expenditure on R&D and public expenditure on R&D figures* yield that Turkey has the highest rank in GDP, population and public expenditure on R&D and is the second best in business expenditure in R&D.

According to the results of the *SWOT Analysis* in innovation performance, Turkey *strengths* are presented as being a secular state with an established democracy; a long history of integration with the world free market economy; a comparatively large economy; a geopolitical position (being close to energy sources); a young population; state R&D institutions and incentives; R&D departments in private enterprises; multinational brands and a Mediterranean location. Some of the Turkey’s *weaknesses* of Turkey are a poor education system; a lack of population control; high rural/urban immigration; lack of financial resources; the insufficient infrastructure (transportation, communication, energy, etc); low rate of FDI because of the geopolitical position; having a follower strategy instead of being a leader; lack of economic, social and political stability over time situations and small, traditional family companies with a negative attitude to innovation. In contrast, the *opportunities* Turkey offers for innovation are rapidly changing technology; integration with European Union on innovation projects, and the possibility of becoming a center of innovation for Asian-Turkish states. Turkey's *threats* in the process of innovation are: politically unrest of the region (risk of the war, etc…); unexpected change in technology; automation trend (thus reducing the advantage of cheap labor force); international regulations and standards and risk of monopolization.

After investigating Turkey's innovativeness, *for further research*, an innovativeness of a specific industry in Turkey can be examined. In addition to that, the innovativeness of a particular industry in one of the candidate country can also be obtained. Similar research in other candidates and also member countries would perhaps yield conclusive results for that industry in EU.

As a result, innovation is a scientific definition and it is *vital* for any society in order to improve their competitiveness.

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