T.C. YEDİTEPE UNIVERSITY
GRADUATE INSTITUTE OF SCIENCE AND ENGINEERING

MANAGING NATIONAL INNOVATION SYSTEM OF TURKEY: A METHODOLOGICAL FRAMEWORK

by

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Submitted to the Institute for Graduate Institute of Science and Engineering
in partial fulfillment of the requirements for the degree
of Master of Science
in Systems Engineering

İSTANBUL, 1999

MANAGING NATIONAL INNOVATION SYSTEM OF TURKEY: A METHODOLOGICAL FRAMEWORK

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Date of Approval : 22/03/1999

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LIST OF ABBREVIATIONS

CHP	Cogeneration or Combined Heat and Power
CLD	Casual Loop Diagram
CPM	Critical Path Method
GDPM	Goal Directed Project Management
KBS	Knowledge-based System
LIBA	Local Industrialists and Businessmen's Associations
MNIS	Management/Managing of the National Innovation System
MORN	Multimedia Object Relation Network
NIS	National Innovation System
NPC	National Productivity Center
OECD	Organization for Economic Co-operation and Development
PERT	Program Evaluation and Review Technique
PET	Politics, Economics and Technology
P-S-O	People-System-Organization
R&D	Research and Development
SIS	State Institute of Statistics
SME	Small and Medium-sized Enterprises
SMIDO	Small and Medium Industry Development Organization
STRCT	The Scientific and Technical Research Council or Turkey
TDFT	Technology Development Foundation of Turkey
TGNA	The Turkish Grand National Assembly
TGNANIC	The Turkish Grand National Assembly National Innovation Commission
TIBA	The Turkish Industrialists and Businessmen's Association
TPI	Turkish Patent Institute
USA	United States of America
WWW	World Wide Web

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ACKNOWLEDGMENTS

I would like to express my gratitude to my thesis advisor Dr. M. Atilla Öner for his invaluable comments, his advices and help throughout my study.

His experience on technology and project management, and his knowledge and thinking on innovation diffusion on a national basis encouraged me for this thesis. It was a great honor for me to study with him.

I would like to express my best regards to Asst. Prof. Dr. Nuri Başoğlu and my System Simulation Course instructor Asst. Prof. Dr. Baransel Atçı for their invaluable comments.

I would like to thank to my friend and webmaster of my thesis web site Alper Özpınar for his valuable work.

I would like to thank to my wife and my sons for their tolerant attitudes during my thesis study.

ABSTRACT

Systemic approaches are giving new insight into economic and the innovative performance of a country. Technology related analysis has traditionally focused on inputs and outputs. But the interactions among the actors involved in technology development are as important as investments in research and development.

Today, in the ***information age, knowledge-based economy*** is getting more important. ***"Knowledge-based economy", "technological chances"*** and ***"National Innovation System"*** should be considered as a whole. An understanding of this system can help policy makers develop approaches for enhancing innovative performance of a country.

The National Innovation System of a country directs attention to information and technology flow within enterprises, universities, research institutions and other related government and non-government organizations.

This study discusses "***National Innovation System***", explains knowledge flow, defines the relations between the actors and develops a methodology for managing ***the National Innovation System of Turkey***.

ÖZET

Sistemik yaklaşımlar, bir ülkenin yenilikçi ve ekonomik performansına yeni bir bakış açısı vermektedir. Bugüne kadar teknolojiye yönelik yapılan analizler, girdi ve çıktıya yönelik bir yapıda olmuştur. Halbuki, teknoloji geliştirmede aktörler arası ilişkiler, araştırma ve geliştirmeye yapılan yatırımlar kadar önemlidir.

"Bilgi çağı" diye tanımladığımız günümüzde, ***"bilgiye dayalı ekonomi"*** önem kazanmaktadır. ***"Bilgiye dayalı ekonomi"***, ***"teknolojik değişiklik"*** ve ***"Ulusal Yenilik Sistemi"*** bir bütündür. Bu sistemin anlaşılması, politika yapıcılara ülkenin yenilikçi performansını geliştirme imkanını sağlar.

"Ulusal Yenilik Sistemi", toplumun geneli ile şirketler, üniversiteler, araştırma kurumları ve diğer ilgili kurum ve kuruluşlar arasındaki teknoloji ve bilgi akışına dikkati çeker.

Bu çalışma, sistem yaklaşımı anlayışıyla **"Ulusal Yenilik Sistemi"**ni tartışmakta, bilgi akışını açıklamakta, aktörler arası ilişkiyi ortaya koyarak, proje yönetimi tekniği ile ***Türkiye'nin Ulusal Yenilik Sistemi***'nin yönetimi için bir metodoloji önermektedir.

1. INTRODUCTION

The next thousand years are going to be ***"information age"***. Only the civilizations that can produce and manage information are going to survive in the future. For this reason, in addition to producing information; to achieve, collect, share and manage information has become an important discipline.

Innovation management can be defined as "*to produce, reach and manage information*". Besides the importance of producing information, to increase its sharing within a very short time to the people that need it is a very important process. If an information can not be shared, it is hard to produce added value. The more the information is shared, the more its activity is going to increase. We can see that developed countries and organizations like the European Commission manage information very well and maximize benefit by setting up linkage among firms, universities, governments and people (**Bosworth, Stoneman and Sinha**, 1996), (**European Commission**, 1997), (**IMIT**, 1996), (**OECD**, 1997e).

Innovation is a learning process. Innovation is a shaped form of social, cultural and organizational details that creates, activates and distributes resources. Circulation and sharing of resources among entrepreneurs has great importance. This ***power distribution*** is an important factor in learning. If the transfer of resources from producer to user is not efficient, in this case, innovation is not efficient too. Interaction of technology between producers and users in a country, which can be defined as ***national dynamism***, is more important than ***international dynamism.*** An effective management of ***National Innovation System*** in a country brings international dynamism together. The effective usage of science and technology should be considered when managing ***the National Innovation System.***

The recent advances in our country in the fields of science and technology has been much satisfactory. The fact that Turkey holds the 27th place in the listing of academic publications may be considered as the proof of our country's improving scientific level

(**Cumhuriyet Bilim Teknik,** Jun. 1998). The systematization of scientific and technological development can be managed only through an active policy of innovation.

The goals of **"National Innovation System (NIS) of Turkey"** project can be defined as follows:

a. Inducing increases in government and non-government organizations' investments in the fields of science and technology to improve and develop scientific and technological competencies of Turkish people.
b. Forming a strategy for the scientific development of Turkey in strategic, economic and social fields.
c. Increasing enterprises' productivity.
d. Forming and developing of communication among non-government organizations, firms, universities, and government organizations.

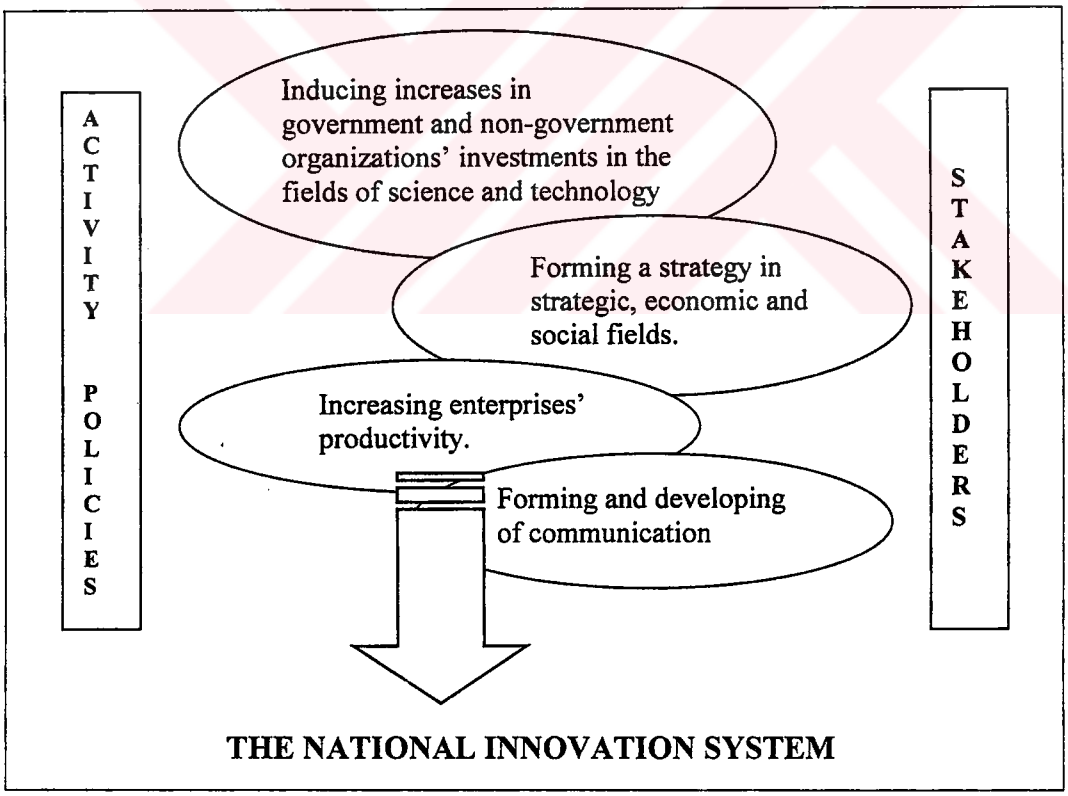

Figure 1.1 The goals of National Innovation System of Turkey project

The following points can be made about the *current situation in Turkey*:

a. Scientific and technological developments are not considered in a systematic approach,
b. Monitoring organizations in the fields of science and technology are not as active as it is needed for an effective ***National Innovation System.***
c. Communication among people, government, organizations and firms is not effective and efficient.
d. The cycle of diffusion and sharing of science and technology is working very slowly.
e. "Impact assessment" is not included in incentive policies directed towards innovation and knowledge production.
f. There is not a specific methodology on *"Innovation Management"*.

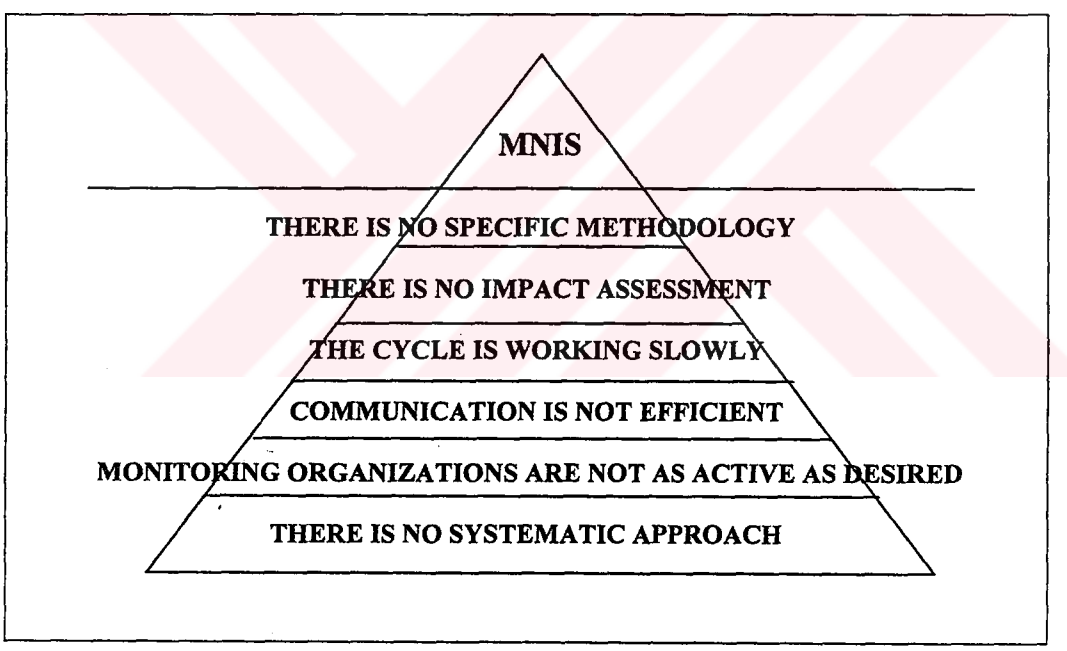

Figure 1.2 Determined points on the current situation in Turkey

The project, ***"National Innovation Project – Technological Change and Monitoring Innovation Processes in Turkish Manufacturing Industry"*** supported by the Prime Ministry and with participation of *STRCT*, *TDFT*, *SIS*, *SMIDO* and *TPI*, has begun in January 1998. This project has a rather narrow scope since it is focused only on manufacturing industry (**Göker**, personal communication). Defining this project within

the larger scale of the ***"National Innovation System"*** would yield much better results. This project will be discussed in more detail in chapter 6.4.

"***Systems of Innovation***" approach, as a new approach for the study of innovation in the economy, has emerged during the last decade. Innovation may be defined as "*brand-new*". But it is more often new combinations of existing elements. Innovations may be of various kinds such as ***technological*** and ***organizational innovation***. Technological innovation is more complicated.

Innovation processes occur over time and are influenced by many factors. Firms can not isolate themselves from innovation. In their quest for innovation they interact with other organizations to obtain, develop and exchange various kinds of knowledge, information and other resources. These organizations may be other *firms*, but also *universities*, *research institutes*, *investment banks*, *schools*, *government ministries*, *consultant organizations* etc. The most important aspect in innovation process is ***interaction between various organizations operating in different institutional contexts***. The entire elements of the system as well as the actors are very important for the creation and use of knowledge for economic purposes (**DACST of South Africa**, 1996), (**Edquist**, 1997), (**OECD**, 1997e).

We must take all important factors shaping and influencing innovation into account for describing, understanding, explaining and influencing processes of innovation. The center of modern thinking about innovation processes are efforts to understand the structure and dynamics of a system.

2. METHODOLOGY

There are three different methodologies used in this study. These are:

a. ***PET*** (Politics, economics and technology),
b. ***MORN*** (Multimedia Object Relation Network) and,
c. ***GDPM*** (Goal Directed Project Management).

2.1 PET

This is a very useful methodology for these kinds of big scale projects in terms of ***planning*** and ***organization***.

PET is a data collection methodology developed by K. Matthias Weber (**Weber**, 1996). It is firstly applied to the case of cogeneration or combined heat and power (CHP) in the United Kingdom. ***PET*** is an interdisciplinary and conceptual framework. This methodology can be used as a foundation for problem and policy-oriented diffusion studies. Further description of the methodology is given in chapter 4. Based on this approach, the ***National Innovation System of Turkey*** is defined in the same chapter.

2.2 MORN

Identifying the informational needs of the stakeholders and determining a suitable means of meeting these needs is an important factor for project success. Information distribution involves making needed information available to project stakeholders in a timely manner (**William**, 1987).

MORN is a very useful methodology for managing these kinds of big scale projects in terms of ***communication infrastructure***. This methodology provides us a web-based communication model.

This methodology developed by Asst. Prof. Dr. Nuri Başoğlu of Boğaziçi University is used as an information infrastructure in this study. Information infrastructure for statistical

and scientific research in fields like biomedicine, astronomy and socio-economics require knowledge-based system (*KBS*) support. ***MORN*** is a knowledge-based system to support research projects.

The system is based on a *semantic network* which is published on the *www*, where project team members have the opportunity to access and manipulate this network. The network consists of nodes and arcs (link). Each node, as an object, represents an idea, statement, concept, document, website, hypothesis etc. With the objective of establishing an harmonic unification of information, the system has been designed to store any sort of object (abstract or concrete). The daily operation is to collect and store any piece of "*thing*" in the knowledge base, then gradually drive them into more appropriate "*positions*". In regular sessions, association of nodes are searched and defined by the team members (**Başoğlu and Öner**, 1998). Object report of ***MORN*** according to key words is enclosed as Appendix 2.

2.3 GDPM

This is a very useful methodology for managing of these kinds of big scale projects in terms of ***project management.***

GDPM is a new project management methodology developed by Andersen, E., Grude, K. V., and Haug, T (**Andersen, Grude and Haug**, 1995). This methodology does not discuss traditional network planning such as *PERT* and *CPM*. Instead it provides a new way of looking at project tasks. This methodology has a broader perspective than the other project management methodologies and concentrates on ***P-S-O (People, system, organization)***. Based on this methodology, the ***National Innovation System of Turkey*** is defined in chapter 6.

2.3.1 People, System, Organization (P-S-O) concept

As it is known, the greater part of project literature concerns technical projects, such as construction of bridges, roads, airports or oil platforms. But there should be a broader

perspective for *project management*. *Goal Directed Project Management (GDPM)* by Andersen, Grude and Haug is involved in ***P-S-O projects***. ***P-S-O*** stands for ***people***, ***system*** and ***organization***. ***P-S-O projects*** are projects where development of a "*system*" (for example, a physical product or object) and development of *people* and *organizations* will occur simultaneously. This can be called as "***P-S-O way of thinking***" in project management.

The ***P-S-O concept*** emphasizes the importance of balancing all three elements; people, system and organization. "***S***" stands for technical aspects of the project. It often represents what we can "*touch and feel*" in the project. For example, in a construction project, the new building is the "S". The most common fault in project work is to focus too strongly on the technical content. In typical organizational development projects the situation is the reverse. These are only concerned with increasing human potentials in organizations and relationships between them. There is not enough emphasis on developing systems (e.g. routines and procedures) which will support the changes required in the organization. ***P-S-O projects*** are projects where the result should be a composite "*product*", where goals should be achieved in all "***P***", "***S***" and "***O***".

One of the most important and characteristic aspect of project work is the extent to which people involved in the project (who will use the results) are invited to participate in the work. One extreme is the ***purely specialist project***, the other extreme is the ***purely process-oriented project***.

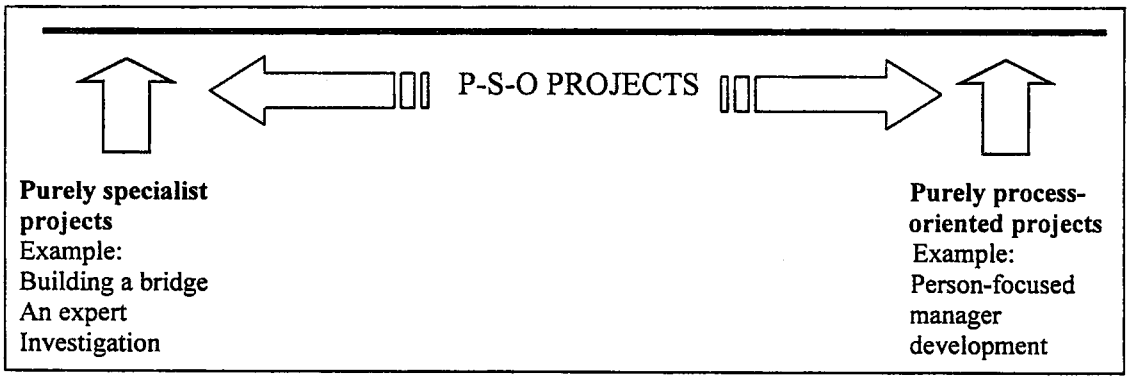

Figure 2.1 Different types of projects (**Andersen, Grude and Haug**, 1995).

In purely specialist projects all the work is performed by specialists without any form of cooperation or consultation with the end users. There is no place for user cooperation. In purely process-oriented projects, on the contrary, everyone is encouraged to become involved and the project is allowed to be dominated by whatever problems and possibilities the participants see as being most important at any given time. The process itself (the interaction between people and what it leads to) determines the progress of the project. All ***P-S-O projects*** are "***mixed***" projects. They contain elements both from the process-oriented approach and from the specialist project (**Andersen, Grude and Haug**, 1995).

2.3.2 Overview of Goal Directed Project Management (GDPM) methodology

In ***P-S-O projects*** goal management is absolutely essential. Defining the goal is simpler when constructing a bridge or building a house in technical projects. But the goal is more abstract in ***P-S-O projects***. The method presented in the book titled "***Goal Directed Project Management (GDPM) by Andersen, Grude and Haug, 1995***" contains procedures and tools which support project management.

Table 2.1 Overview of Goal Directed Project Management (**Andersen, Grude and Haug**, 1995).

Task / Level	Project planning	Project organization	Project control
Global level (project level)	Objective breakdown structure Project mandate Milestone plan	Principle responsibility chart Project responsibility chart	Milestone report Project report
Detail level (activity level)	Activity responsibility chart		Activity report

The *project mandate* provides the background for the project and shows what its goal is. The *objective breakdown structure* assists in setting the boundaries of the project and defining the goals precisely. The *milestone plan* is a global plan for project progress, with checkpoints in the form of milestones to be achieved. The *principle responsibility chart*

shows the division of work between the different parties involved in managing the project. The *project responsibility chart* shows who is responsible for attaining the different milestones. The *activity responsibility chart* describes in more detail who should work on the different activities necessary for reaching a milestone. The *milestone report* shows where the project is in relation to the milestone plan. A *project report* reveals if the responsibility chart is kept to. An *activity report* is used to prepare a detailed report of project work progress (**Andersen, Grude and Haug**, 1995).

3. SYSTEMS OF INNOVATION

3.1 The Emergence of the "Systems of Innovation" Approaches

The ***National Innovation Systems*** approach is based on *the flows of technology and information among people, enterprises, institutions/organizations, universities and other related sides* that are the key to the innovative process.

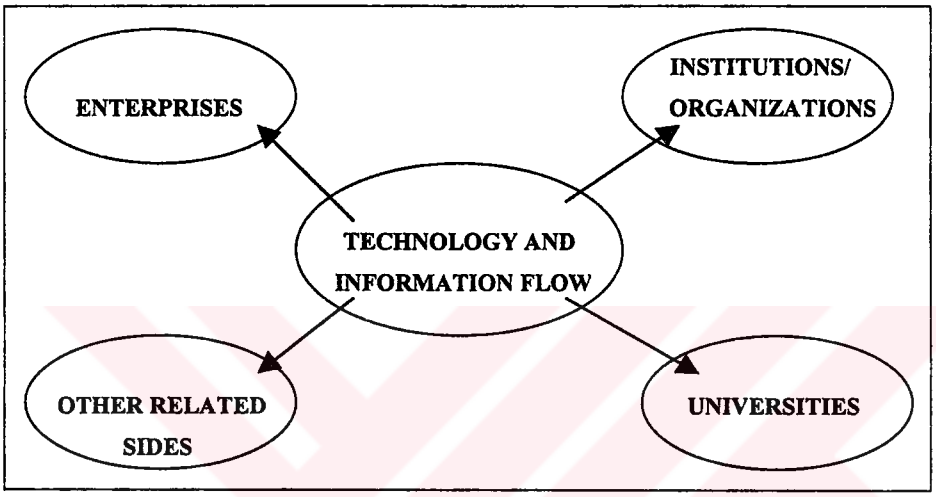

Figure 3.1 Information flow

Innovation and ***technological development*** are the result of a complex set of relationships among actors in the system, which includes enterprises, universities and government research institutions. Policies which look for improving networking among the actors and organizations/institutions in the system aim at increasing the innovative capacity of firms.

The innovative performance of a country depends on a large extent on how these actors relate to each other as elements of a collective system of knowledge creation and utilization as well as the technologies they use. ***Joint research***, ***personnel exchanges***, ***cross-patenting***, ***purchase of equipment*** and a variety of other channels *are* ***the forms of linkages among the actors***.

The first person to use the expression "***National System of Innovation***" is said to be Bengt-Ake Lundval. But, the expression was first used in published form on the book

titled "Technology Policy and Economic Performance in Japan" by Chris Freeman (**Edquist**, 1997).

Two major books, by Bengt-Ake Lundvall and Richard Nelson, on ***National Innovation System*** were published in the early 1990s. Carlsson and his colleagues talked about *"technological systems"* within a research program led by Bo Carlsson in 1995. They argued that technological systems are specific for various technology fields and for this reason their approach is sectoral rather than national. Their technological systems approach has important similarities with *"systems of innovation"* approaches (**Edquist**, 1997).

These are not the only documents that are using the systems of innovation approach. Systems of innovation approach is also very much used as a policy context by governments as well as by international organizations like European Union and OECD.

The development of systems of innovation approaches has been influenced by different theories of innovation such as ***evolutionary theories*** and ***interactive learning theories***. Lundvall has tried to relate the ***National System of Innovation*** approach to ***innovation theory***. This theory stresses processes of learning and user-producer interaction.

In Lundvall's words:

> "One of our starting point is that innovation is a ubiquitous phenomenon in the modern economy. In practically all parts of the economy, and at all times, we expect to find on-going processes of learning, searching and exploring, which results in new products, new techniques, new forms of organization and new markets. In some parts of the economy, these activities might be slow, gradual and incremental, but they will still be there if we take a closer look" (**Edquist**, 1997).

Several innovation theorists have expressed that legal conditions, rules and norms will significantly affect an organization's inclination and possibility to innovate. The actors such as universities and public research laboratories that are involved in generating and diffusing innovations are not primarily governed by profit seeking motivations. Legal conditions should be established to support these kind of actors for innovation process.

Nelson and Winter propose an ***evolutionary process*** as an alternative to understanding technical change to be the result of seeking to maximize profits. *The evolutionary of technological change* often contains the following components:

a. The existence and reproduction of entities like genotypes in biology or a certain set-up of technologies and organizational forms in innovation studies are the point of departure.

b. There are mechanisms that introduce novelties in the system, i.e., creates diversity. The novelties are *mutations* in biology and in our context they are *innovations*.

c. There are mechanisms that select among the entities in the system. This selection process reduces diversity. These mechanisms may be the *"natural selection"* of biology or the *"market selection"* of competition as regards to technical change. The selection mechanisms constitute a filtering system that functions in several stages and leads to a new set-up of technologies and organizational forms (**Edquist**, 1997).

Technological change is an open-ended and path dependent process. There can not be an identified optimal solution to a technological problem. According to Nelson, in capitalist countries, technical change is set up as an evolutionary process. Nelson and Rosenberg's approach of the systems of innovation is based on an evolutionary theory of innovation. Without mentioning evolutionary theory, however, an evolutionary framework as well as the evolutionary foundations of learning-by-doing has been discussed in Lundvall's publication. As well as Lundvall and his colleagues, Carlsson, Nelson and Rosenberg committed to the idea that technological change is an evolutionary process.

There is a close harmony between the ***systems of innovation approach*** and ***evolutionary theories of innovation***. Interactive learning and evolutionary theories of technological change are certainly compatible with each other. They constitute origins of the systems of innovation approach.

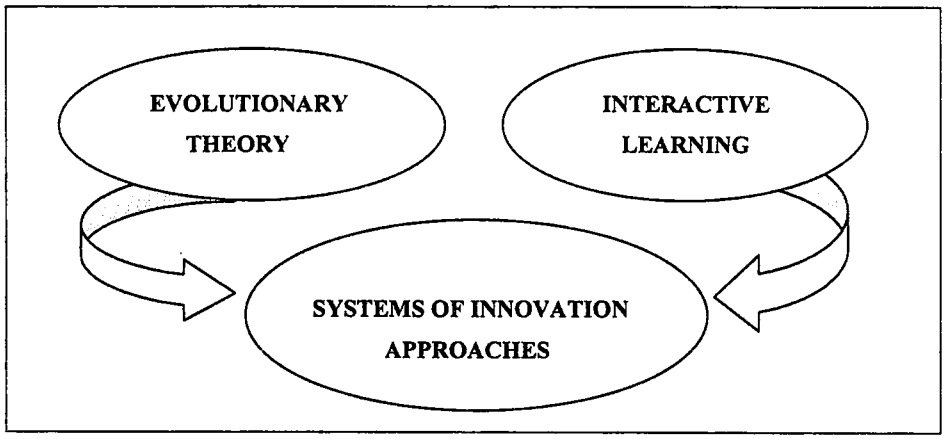

Figure 3.2 The systems of innovation approaches

Despite different interpretations of the systems of innovation approaches, they are all innovation-oriented.

Technologies are not only developed but also produced and diffused. Because of that, technologies are also developed outside the formal Research&Development (R&D) system through, for example, learning-by-doing, learning-by-using and learning-by-interacting; the systems of innovation approach goes beyond R&D.

Innovation as conceived by Nelson, Rosenberg, Carlsson and Stankiewicz is narrow in the sense that is restricted to technical innovation. The innovation concept is, however, not always restricted to technical innovations. Lundvall discusses innovation in a different manner. He mentions "*new forms of organization*" and "*institutional innovations*". Generally speaking, all authors working within the systems of innovation approach are centrally focused on technological innovation and, in addition, all are interested in *organizational* and *institutional change* (**Edquist**, 1997).

The *systems of innovation* approach allows for the inclusion not only of economic factors influencing innovation but also of institutional, organizational, social and political factors. The systems of innovation is an ***interdisciplinary approach***. Perhaps it might be best labeled as a ***"political-economic"*** approach.

3.2 Common Characteristics of "Systems of Innovation"

The common characteristics of the *systems of innovation approaches* are (**Edquist**, 1997):

a. Innovation is a learning process such as learning-by-doing, learning-by-using and learning-by-interacting. "*The knowledge-based-economy*" and "*the learning economy*" are the most fundamental resources in modern economy.

b. The *systems of innovation* approaches can be characterized as "*holistic*" and "*interdisciplinary*".

c. The natural resources and the economic history of a country play an important role in determining the direction of innovation. In countries like South Korea and Japan the natural resource base may have been less important, while civilian technology policy has been more important for the development of the systems of innovation. In such cases, other resources, for example human resources such as knowledge and competence, have been created as a substitute for the lack of natural resources. In the USA, military R&D and technology policy may have been crucial factors for the development of the systems of innovation.

d. The *systems of innovation* of various countries, regions, sectors can differ from one another. For example, in some countries raw-material-based production is important, in others knowledge intensive production is more dominant. For these and other reasons systems differ in the amount of resources spent on R&D and innovation, their performance in terms of technology development and diffusion.

The organizations and institutions forming elements of the systems of innovation may be different in various countries, regions or sectors. For example, research institutes and company-based-research may be important for the R&D system in one country while research universities may perform a similar function in another country. Japan and USA are good examples for this case. As it is known, legal systems, norms and values also differ from country to country. For these reasons, each country has its own ***National Innovation System***. Due to the fact that evolutionary learning processes are important and they are subject to continuous change, we can not define an optimal *system of innovation.*

e. Innovation can be considered to be *new combinations* of elements of existing and/or new knowledge. These knowledge elements often originate from different actors and agents such as firms, universities, schools, government organizations/agencies,

training institutions, etc. When innovating, these elements interact closely with each other and they do so in the context of existing rules, laws, regulations and cultural habits. These relations are not characterized by linear casual relationships. These relations are very complex and often characterized by interactivity and feedback mechanisms in several loops.

f. The *systems of innovation* encompasses product technologies and organizational innovations. Technological product innovations are probably more important than technological process innovations in some countries. Product innovations is the main mechanism effecting structural change in economics and leads to the substitution of old goods and services or to the satisfaction of new needs. Hence, product innovation seems to be the more important part of technological innovation. This is probably the reason why Lundvall, Nelson and Carlsson include product innovations in their concept of innovation. Developments in production have led managers and researchers to give more emphasis to organizational change (such as *Just-in-time* and *lean production*) as a source of productivity growth and competitiveness.

g. The *systems of innovation* can be described as "*the network of institutions*". Institutions are of crucial importance for innovation processes. Hence, institutions are central in all version of the systems of innovation. But, it must be known that institutions play different roles for innovation. They may also become obstacles to innovation. Generally, institutions tend to live a life of their own and may become unsuitable to perform functions they previously performed or they were originally intended to. *Institutional change* is mandatory. But there is often extreme resistance to such change. At this point, replacing them with alternative ones may be necessary.

h. *The systems of innovation approach* is associated with various kinds of uncertainties. There are different definitions for the systems of innovation defined by different authors. The limits of the system, core elements in the systems of innovation and the relations between these could not be defined in an operational way.

i. *The systems of innovation approach* is not a formal theory. It does not provide convincing propositions as regard to established and stable relations between variables. The systems of innovation approach is characterized by a rather uninhibited formulation of conjectures.

3.2.1. The concept of "systems of innovation"

The concept of "*systems of innovation*" should be clarified for these four general reasons:

a. Conceptual clarity is a precondition for identifying research questions and for formulating conjectures and theories.

b. It is necessary for communication. We do not understand each other if we can not make clear what we mean when using key concepts.

c. It is required for carrying out theoretically based empirical studies. Clearly defined concepts are necessary in order to make it possible to identify empirical correspondents to theoretical constructs and to identify the data that should be collected.

d. Ambiguity of key concepts reduces the credibility of the researcher and the approach (**Edquist**, 1997).

There are some conceptual ambiguities for the definition of the *systems of innovation* approach. In fact, this ambiguity did not emerge with the systems of innovation approach. It is associated with innovation studies and the economics of technical change in general.

The concept of "***National Innovation System***" involves two hypothesis; *innovation is a process of learning* and *it is shaped by social, cultural and institutional particularities that create, mobilize and distribute resources*. The production of knowledge is not sufficient to induce innovation but the critical situation is the circulation of the resources between enterprices (**Masinda**, M.T.).

Christopher Freeman defines a ***National Innovation System*** as: "**the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies**"(**Edquist**, 1997).

Lundvall defines the concept of a ***National Innovation System*** in a broad sense: "**...all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring...**". According to Lundvall, a definition of the ***National Innovation System*** must be kept open and flexible. The boundaries of a ***National Innovation System*** can not be sharply determined (**Edquist**, 1997).

Carlsson defines a technological (sectoral) system rather than the national approach as: "**a network of agents interacting in a specific economic/industrial area under a particular institutional infrastructure or set of infrastructures and involved in the generation, diffusion and utilization of technology** (**Edquist**, 1997).

Other definitions for the ***National Innovation System*** are:

"**... a set of institutions whose interactions determine the innovative performance... of national firms**" (**OECD**, 1997e).

"**... the national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning**" (**OECD**, 1997e).

"**... 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....**" (**OECD**, 1997e).

"**... a set of functioning institutions, organizations and policies which interact constructively in the pursuit of a common set of social and economic goals and objectives**" (**DACST of South Africa**, 1996).

As it is seen, there is no single accepted definition of ***National Innovation System***. But we can understand from the definitions that the ***National Innovation System*** is the *economic role of knowledge, flows of knowledge* and *diffusion of knowledge* oriented. The ***National Innovation System*** statement consists of three concepts; "***national***", "***innovation***" and "***system***". Discussion of these three concepts is going to assist better understanding of the ***National Innovation System***.

In fact, defining the limits of the ***National Innovation System*** is hard. When we investigate literature, it is seen that some of the authors discuss it in *national sense* and others discuss in the sense of *technological innovation*.

The aim of the ***National Innovation System*** is *to try to create the conditions that will support both creativity and innovativeness throughout our society.* The ***National Innovation System***, in its broadest description, is the means through which a country seeks to create, acquire, diffuse and put into practice new knowledge that will help that country and its people achieve their individual and collective goals (**DACST of South Africa**, 1996).

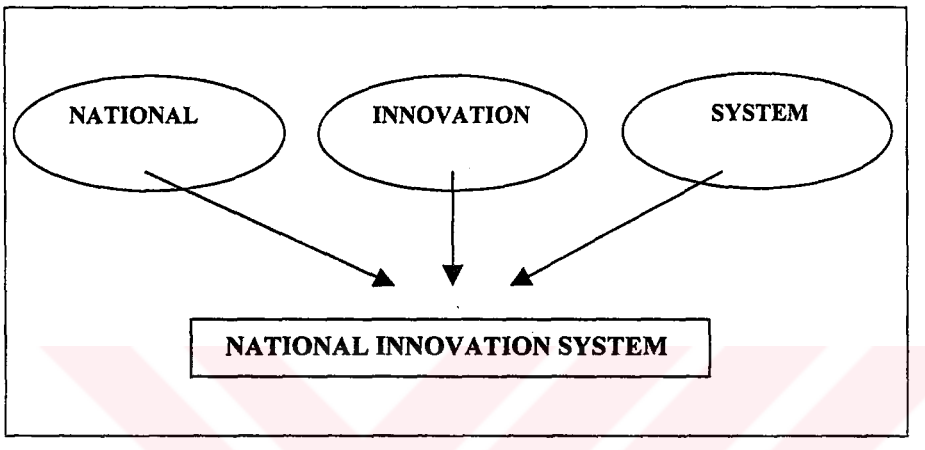

Figure 3.3 National Innovation System concept

3.2.2 The concept of "innovation"

Innovation has a "*dynamic*" feature. Innovation can be defined as a process that lasts from coming out to the realization of a thought. Innovation should not be confused with the concepts of *creativity* and *invention.* Creativity and invention can bring about an innovation only when they are commercialized (**Yenilik, Büyük Larousse,** volume 20).

Innovation not only takes place within a social system, but also takes place over time. Diffusion, therefore, is a model which has been frequently applied to the adoption of innovations, in fields as varied as rural, educational, industrial, medical etc. Innovativeness describes a set of attitudes or values that are open to accept change (**Hall**, 1977).

Invention may be motivated either primarily by a desire to advance technique or primarily to satisfy a specific market need. The first motivation has been called ***technology push***

and the second ***market pull***. Whether motivated by market pull or technology push, commercially successful innovation should match technological superiority to market application and provide competitively priced, high quality goods (**Betz**, 1994).

Innovation is a very important survival issue. Innovation does not tend to arise by itself. It is generated and kept going through the efforts of people. Innovation can not be legislated. It can not be decreed. It comes from individuals and from creative and interactive communities. Innovation resembles happiness. There should be a convenient environment for its encouragement and support. Government therefore needs to work hard at creating an environment that is supportive of innovation. Otherwise innovators will either not innovative or they will leave their home environs for more encouraging societies (**DACST of South Africa**, 1996).

In an innovative society, individuals, groups, organizations, government and Parliament should recognize that they are partners, rather than opponents or controllers. Collaboration and common purpose forms healthy competition, openness and accountability. An important element of innovation is resolving dilemmas to reconcile apparently competing values. Truly innovative societies can meet real needs and control costs, satisfy societal priorities, considering both economics and compassion (**DACST of South Africa**, 1996).

An innovation can not be directly transferred, because no two social systems can enact exactly the same two chains of events. Innovation can only be transferred in reconstructed form, i.e. as descriptions, drawings, narratives, recipes, tools, manuals, etc. When the innovation is being reconstructed, it becomes more specific, standardized, consisting of components that logically fit together in the system (**IMIT**, 1996).

Innovation is the application in practice of creative new ideas. This situation involves the introduction of inventions into the market place. In contrast, creativity is the generating and articulating of new ideas. People can be creative without being innovative. They may have ideas or produce inventions, but may not try to win broad acceptance for them. They put them to use or exploit them by turning their ideas into products and services that other people will buy or use.

Similarly, people can be innovative without being creative. For example, if they apply or implement ideas or inventions that were made elsewhere, they are being innovative, even though the inventions or creative ideas were not their own. Some innovations are truly revolutionary, while most represent modest improvements in the way we do things. Competitive companies are continually introducing incremental innovations to improve the products they sell or the processes they use in production. Only rarely, they will introduce something radically new into the market place (**DACST of South Africa**, 1996).

Innovation is composed of two parts; the generation of an idea or invention and the conversion of that invention into a business venture or to some other useful application. There should be appropriate idea generators, program manager/leader and sponsor/coach for an effective innovation (**Roberts**, 1998).

3.2.3 Types of innovation

We can distinguish four types of innovation which are, *radical innovation*, *incremental innovation*, *systems innovation* and *next-generation technology innovation* (**Betz**, 1994).

Radical innovation provides a brand new functional capability, which is a discontinuity in then-current technological capabilities. This functionality provides opportunities for new business ventures and even for new industries. Examples of radical innovations include electron vacuum tubes, transistors, semiconductor integrated circuits, computers, lasers and recombinant DNA techniques.

Incremental innovation improves the existing functional capability of an existing technology through improved performance, safety, quality and lower cost. Examples of incremental innovations include improved doping techniques in transistors, improved memory devices in computers and so on.

Systems innovation is a radical innovation that provides new functional capability based on reconfiguring existing technologies. Examples of systems innovation include the systems innovation of the automobile and new gasoline engine technology.

Incremental innovations within a system can also sometimes create new technical generations of a system. Such an innovation is still a kind of systems innovation but not a radically new innovation. It is a systemic innovation that some have called a ***next-generation technology innovation***.

Innovation can be separated as ***technological*** and ***organizational*** or ***social*** innovation, and should be discussed in ***supranational***, ***national***, or ***subnational (regional or sectoral)*** dimensions.

3.2.4 The concepts of "supranational", "national", "regional" and "sectoral"

The concept of *"national"* has a broad sense. An innovation system can not only be *national*, it can also be *supranational*. Supranational can be truly global, or it can include only part of the world.

Supranational concept explains an international system. An international organization is interested in *supranational innovation system*. In this case, differences between the national innovation systems are considered. Language, culture, life style, economic system etc. effect the national innovation system.

An innovation system can be "*subnational*", or it can include only part of a country. It can also be sectoral within a country. An innovation system can also be supranational and regional at the same time. Sectoral innovation systems include only a part of a regional, a national, or an international system (**Edquist**, 1997).

3.2.5 The concept of "system"

The concept of *system* can be defined in a broad sense as the set of elements that interact with each other for a common goal.

There are two general kinds of systems; ***open systems*** and ***closed systems***. An *open system* receives inputs from its environment, processes these, and exports outputs to its

environment. But in a *closed system*, its processes are wholly enclosed, neither receiving inputs from nor exporting outputs to its environment.

All systems have a boundary and an environment. Within the boundary, the system is formed by parts and connections between parts. There will always be at least two subsystems within the system, a *transformation subsystem* and a *control subsystem.*

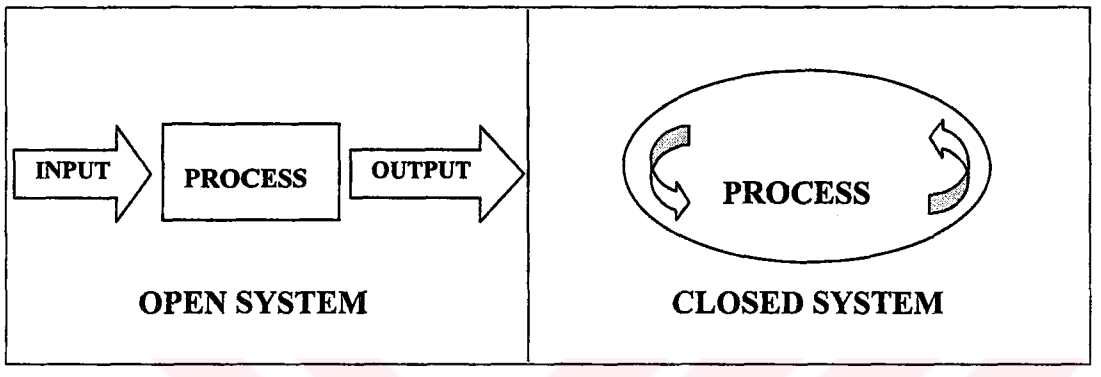

Figure 3.4 Open and closed systems

Transformation that converts inputs to outputs is the functionally dominant process. All technology systems are functionally defined as open systems, accepting inputs and transforming inputs into outputs. The boundaries of a technology system are the points of the physical structure that receive inputs from and which export outputs into the environment (**Betz**, 1994).

The concept of ***system*** in the concept of ***National Innovation System*** includes all important economic, social, political, organizational, institutional and other factors that influence the development, diffusion and use of innovations.

According to Nelson and Rosenberg, *system* is a set of institutions whose interactions determine the innovative performance. This is a broad definition and it provides no sharp guide to just what should be included in the innovation system and what can be let out. Some elements of systems of innovation are consciously designed by actors and sometimes by government policy makers. Other important elements seem to be evolving spontaneously over extended time periods. In fact, a ***National Innovation System*** as a

whole can certainly not to be designed. The definition must be kept open and flexible as regards to which subsystems should be included and which processes should be studied (**Edquist**, 1997).

We can define the concept of *system* in the concept of ***National Innovation System*** as all important economic, social, political, organizational, institutional and other factors that influence the development, diffusion and the use of innovations.

Because of their different structures; national, regional, sectoral innovation systems differ from each other. To describe a system of innovation therefore, it is not sufficient only to list its elements. The relations between the elements must also be addressed.

3.3 Technological Innovation

Innovation is an investment activity. The process involves costs today with the prospect of returns in the future. Therefore, innovation activity means reduced profit for the firm or organization/institution today and the prospect of increased profits in the future. International competition of innovation activity should take this into consideration.

Technological innovation is a matter of producing new knowledge or combining existing knowledge in new ways and transforming this into economically significant products and processes (**Edquist**, 1997).

Technological development requires technological infrastructure. Governments should create an environment conducive to technology acquisition and development, and to offer the right incentives. The appropriate environment also includes an education system that produces quality technical manpower and a technology infrastructure (**World Bank**, 1997).

New technology is to present new things to the market. In technological innovation, there are some important technical risks of meeting business goals in a timely and practical manner (**Betz**, 1994):

a. Can a technical goal be achieved?
b. Can it be achieved on time for a product introduction?
c. Can it be achieved in a reasonable budget?
d. If achieved, can it be produced in a product at a cost that will allow the product to be sold and be profitable?

There are some lessons learned about risks and success in innovation (**Betz**, 1994):

a. If a new technology truly offers new functionality or significantly superior performance, it will succeed as an innovation.

b. Technologies are systems. A new technology can not succeed until the system as a whole is complete and competent enough for an application.

c. A new technology diffuses into use for several reasons and the rate of diffusion varies. This rate depends on many factors.

d. The criteria on which a customer judges may be multidimensional and customer judgement may change over time although the customer determines ultimate success or failure of an innovation.

e. Successful products in a new technology depend as importantly on standards and infrastructure as on performance.

f. Because of technical and economic factors, a radically new technology usually requires a new business organization for successful innovation.

The reduction of risks in innovation takes special attention and effort to integrate the two strategic concerns of business and technology. The technical concerns of the engineers must be translatable and integratable into the strategic concerns of management. The problem in managing strategic technologies is to adapt and refine the logic of management so as to effectively deal with the logic of technology (**Betz**, 1994).

3.4 Organizational Innovation

Organization means bringing people to interact with each other and with other resources in order to carry out a certain activity or to obtain a certain purpose. Organization is a complex process. Organization concept that is going to be discussed should be considered

as both organizational and institutional. There are different ways to allocate tasks to people and other resources like capital and equipment, that can also be allocated to tasks in different ways.

Organizational innovations may contribute significantly to better performance. There are "*organizational designers*" for organizational innovation. The designers are policy-makers on both national and international level, managers and union representatives, consultants and participants in projects of various kinds.

Organizational and technological innovations share many of the characteristics with each other. New technology must be accompanied by new ways to organize activities. To be really useful, technological innovation requires organizational innovation. Organizational innovation could improve the performance of a firm and is thus an important driving force behind economic development. Organizational innovations are transferable from one firm to another under certain conditions. This transfer is cumbersome and costly. Therefore it is of interest to find out more about the factors that mediate organizational innovation (**IMIT**, 1996).

There are three specific arguments for including organizational innovations in the concept of innovation (**Edquist**,1997):

a. Organizational changes are important sources of productivity growth and competitiveness and they might also strongly influence employment.

b. Organizational and technological changes are closely related and organizational change is often a requirement for technological process innovation to be successful.

c. All technologies are created by human beings. They are in this sense, socially shaped.

The following points are highlights of the importance and character of the phenomenon of organizational innovation (**IMIT**, 1996):

a. Organizational innovation is an economic growth factor in itself which over and above pure product or process innovation can contribute to the competitiveness and success of a firm and to the development of regional or national economy.

b. Organizational innovation is often a prerequisite for rapid growth of a firm. Such growing firms constitute an important market for products based on new technology.

c. Organizational innovation may provide the motivational and social conditions in a firm which are necessary conditions for future technological innovation.

d. Organizational innovation in a firm may form the platform for a global expansion of that firm.

e. Social agents like bodies on the industry level (e.g., associations promoting total quality management), consultants and top management have important roles to play in bringing organizational innovation about. It is more unclear if and how policy makers can influence the path of technological innovation. The possibilities and methods for achieving organizational innovation are probably more accessible.

Social or organizational innovations can come about as changes in life style, economics, management or policies. Organizational, institutional, structural or procedural novelties can be defined as *social* or *organizational innovation.* This kind of innovations are;

a. More efficient or effective than previous practices,
b. Longer-lasting than just being a passing fad,
c. Broadly enough disseminated to be worth taking seriously and,
d. Able to affect the new directions that society takes.

Organizing does not mean creating stable structures but rather influencing dynamic processes and the flow of activities. The goals of the activities to be organized are not given once and for all but vary over time. An organizational innovation consists both of inventing a new way to organize activities and of applying this invention to the carrying out of activities in practice.

Organizations were called by Weber (1947) "systems of imperative coordination", and this draws attention to the fact that a number of people come together to pursue a common aim. Depending on whether emphasis is placed on the common goals or on the co-ordination towards this goal, two main types of approach may be detected in the sociological study of organizations. In the former, the organization is treated as a system of inter-related parts oriented around a system goal or a set of goals, and in the latter the organization is seen as

the outcome of the actions of its members in which co-operation is achieved rather than assumed (**Hall**, 1977).

Organizations tend to be sediments of a historical flow of events rather than being logical and adequate answers to present-day problems. Therefore, established organizations are often unable to adopt radically changed environments. Governmental organizations have often been molded after a homogeneous bureaucratic model. Sometimes the term "*organization*" has a negative connotation of unnecessary formalism, red tape and lack of flexibility. Organizing has become regarded as an activity to be avoided. People make a distinction between the formal and informal organization. An organizational innovation consists both of inventing a new way to organize activities and of applying this invention to the carrying out of activities in practice.

Technology used by a firm is often thought to be one of the main determinants of organizational structure. More complex technologies are for example assumed to require a more functionally and hierarchically stratified structure. However, new technologies may also be conducive to organizational innovation. Information technologies makes new solutions radically feasible. Institutional arrangements may also serve as a source of organizational change and innovation. To break the barriers for organizational innovation, organizational innovators are needed. Innovators can be two of kinds. First, there are the entrepreneurs that set up a new activity from scratch. Second, there are the managers who change the ways of existing organizations (**IMIT**, 1996).

4. DEFINING THE NATIONAL INNOVATION SYSTEM

It is hard to define the ***National Innovation System*** without using a methodology. An interdisciplinary framework is still missing for technological researches. Existing disciplinary approaches to technological change in sociology, political sciences and economics allow to highlight the role and importance of single political, economic or sociological factors for the diffusion progress of new technologies. An interdisciplinary framework will allow to explain innovation diffusion on the basis of the whole range of these factors. Such a conceptual framework has been defined as the "***PET-system***" by K. Matthias Weber and applied to the energy sector in the case of *cogeneration* or *combined heat and power (CHP)* in the United Kingdom (**Weber**, 1996). Based on this approach, the ***National Innovation System*** is defined in the following sections.

4.1 PET-System Description

PET stands for ***politics***, ***economics*** and ***technology***. The ***PET-system*** constitutes of four analytical levels, which cover both the micro-perspective of actors and interactions and the macro-perspective of structural settings.

Table 4.1 The levels of the PET-system (**Weber**, 1996)

Level	Description
Technology	Technology or technological options which are subjected Changes, transformations and improvements, or even the emergence of substantially new options.
Actors	The level of actors whose interactions and decisions determine the generation and selection of technologies.
Structures	Endogenous environment of the technology and the actors, constituted by the evolving structures of the system (and the prevailing institutions guiding the interactions). Basically, these structural elements provide the settings inside which interactions take place and which in turn are the aggregate outcome of the interactions.
External Factors	Exogenous selection environment which is conceptualised as not being affected by the interactions in the system. The system as a whole adapts to these exogenous changes, but does not affect them significantly.

There are three core elements in the ***PET-system.*** These are ***technology suppliers***, ***technology users*** and ***political authorities*** as the main types of actors. This does not mean that other important factors affecting technological change (both economic factors and factors often referred to as the socio-cultural context) were omitted, but they make part of the external selection environment of the system (**Weber**, 1996).

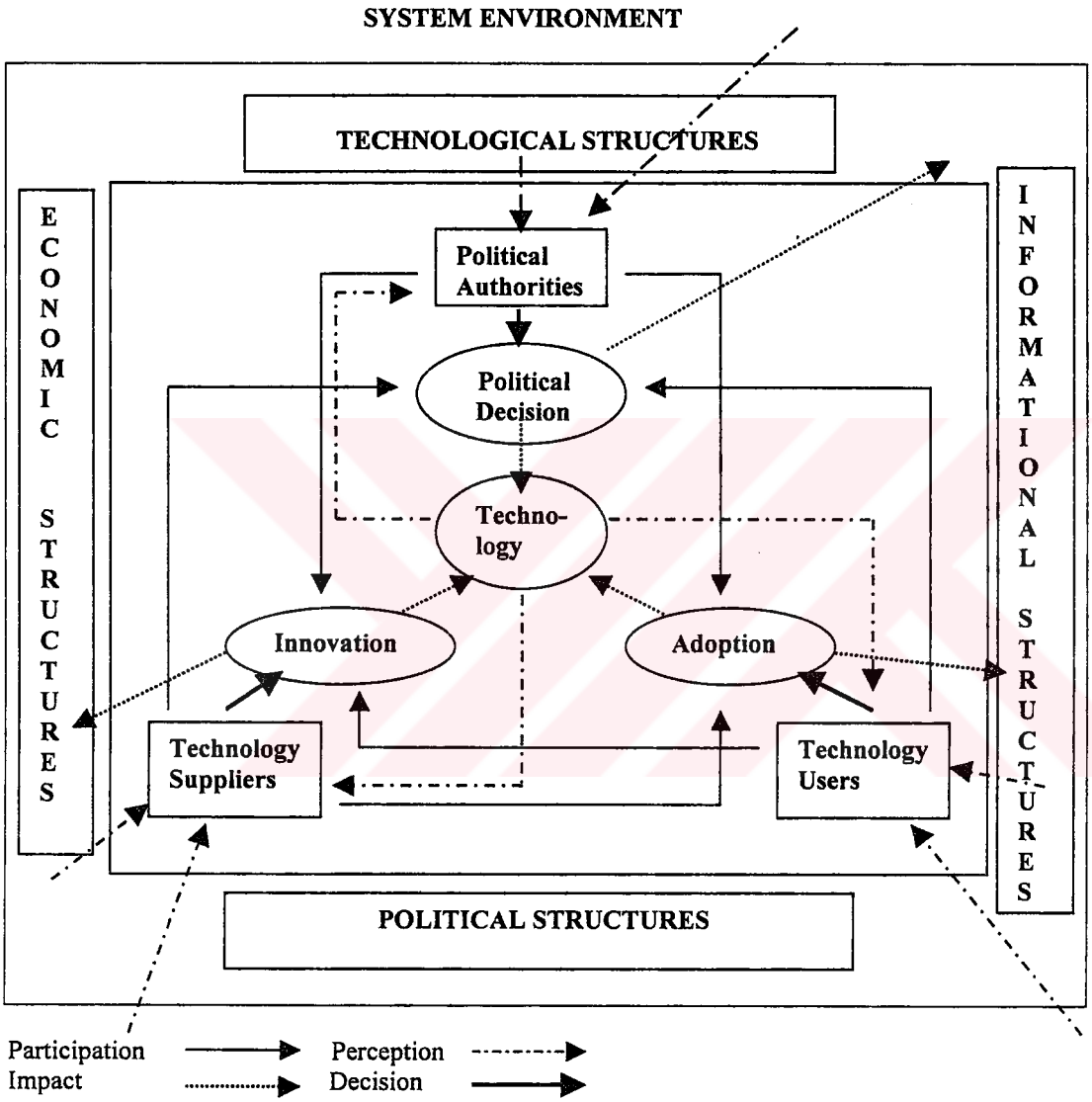

Figure 4.1 The basic set-up of the PET-system (**Weber**, 1996)

All actors defined in ***PET*** potentially participate in all the *three types of decision arenas*; ***innovation***, ***adoption, policy-making*** and by using all the interaction media (information, money, legal measures, artifacts) (**Weber**, 1996).

The methodology suggests us to use following considerations that are shown on following table for research;

Table 4.2 Considerations for researches using PET methodology

Technology	Principles Variations
Structural Changes	Technological Economic Informational Political
Decisions & Interactions Motivations	Innovation Adoption Political decisions
External developments	Developments in the external markets Incentive policies Economical growth Public opinion

4.2 Application of the Methodology to the National Innovation System

National Innovation System is a system like other technological systems and has a set of components. Interactions between components/actors should be defined clearly and in a scientific way. It represents technological change. ***National Innovation System*** is affected by socio-economic structure, government policies and programs, and technological infrastructure of a country. PET methodology is helpful as a frame of analysis for defining the ***National Innovation System.***

4.2.1 Technology diffusion

The ***National Innovation System*** approach has taken on increased analytical importance in the technology field due to (**OECD**, 1997f);

a. The recognition of the economic importance of knowledge,
b. The increasing use of systems approaches,
c. The growing number of institutions involved in knowledge generation.

Innovation is the result of a complex interaction between various actors and institutions. Technical change does not occur in a perfectly linear sequence. It should be considered

through feedback loops within the system. Firms form the center of this system. They organize production, innovation and the channels by which they gain access to external sources of knowledge. These sources might be other firms, public and private research institutions, universities and regional, national and international institutions.

Technology is the main source of long-term economic growth. The ***National Innovation System*** focuses on ***flows of knowledge***. The economic role of knowledge is very important for innovation system. Technology diffusion is the most traditional type of knowledge flow in the ***National Innovation System*** (**OECD**, 1997d).

4.2.1.1 Technology diffusion targets and services

Technology diffusion is not only a simple one-way flow from emitter to receptor. It is a complex process involving the interaction of a variety of actors and organizations, each with different roles; suppliers, producers, adopters, non-adopters, third parties and information networks. Technology can diffuse in multiple ways and with significant variations, across time, over space and between different industries and enterprise types, depending on the particular product or process.

Technology may be acquired from a variety of sources. These sources may be private vendors, customers, consultants and other firms, as well as public technology centers, government laboratories and universities. Technology also diffuses through the internal efforts of firms, the transfer and mobility of personnel, the activities of professional societies, the trade and scientific press, varied forms of informal knowledge trading and practices such as reverse engineering (**OECD**, 1997d).

Government programs for technology diffusion are most often mounted for ***small and medium-sized enterprises (SMEs)***. Compared to large firms, smaller firms are more dependent on external sources of technology and knowledge. Although a small proportion of SMEs have strong internal technology development capabilities, most small firms use technology rather than developing it.

Government technology policy should improve the diffusion performance of existing ***National Innovation System***. There are a diverse set of technology-related infrastructures, institutions and mechanisms in OECD countries. Successful technology diffusion program will address gaps and opportunities in relations, attitudes, structures and practices at multiple levels.

Table 4.3 Levels of technology diffusion programs (**OECD**, 1997d)

GOAL	PROGRAM TYPES	OBJECTIVES
Level 1: Improve adoption and adaptation of specific technologies	Technology-specific	To diffuse a specific technology to a wide number of firms and sectors.
	Institution-specific	To promote technology transfer from specific institutions
	Sector-specific	To diffuse technology to a particular industrial sector
	Demonstration	To demonstrate the practical implementation of technologies
Level 2: Improve general technology receptor capacity of firms	Technical assistance	To assists firms in diagnosing technology needs and in problem solving
	Information networks	Access to information on technology sources, etc.
	Assistance for small-scale R&D projects	Build capacity for autonomous technology development
Level 3: Build innovation capacity of firms	Sector wide technology roadmaps	Systematic planning for future strategic technology investments
	Diagnostic tools	Assists firms to develop innovation-oriented management (includes organizational change)
	Benchmarking	Transmit best practice from elsewhere
	University-industry collaboration	Upgrade the knowledge base of the firm

It can be said that there are three general goals of current technology diffusion programs (**OECD**, 1997d):

a. The programs that improve the adoption and adaptation of specific technologies, including those from certain institutions and aimed at specific industrial sectors,

b. The programs that improve the general technology receptor capacity of firms, including technical assistance projects and information networks.

c. The programs that build the overall innovation capacity of firms, including the use of tools such as sector roadmaps, diagnostics and benchmarking.

Table 4.4 Typology of technology diffusion programs (**OECD**, 1997d)

TYPE	PURPOSE	EXAMPLE
Diffusion targets		
Technology-specific	To diffuse a specific technology to a wide number of firms and sectors.	France PUCE and LOGIC programs
Institution-specific	To promote technology transfer from specific institutions	Germany Fraunhofer Society
Sector-specific	To diffuse technology to a particular industrial sector	Portugal TEXTILE Program
Region-specific	To upgrade the technological capacities of a particular region	Norway Regional Development of SMEs (RUSH)
Diffusion services		
Technical assistance	To assist firms in diagnosing technology needs and in problem-solving	United States Manufacturing Extension Partnership (MEP)
Demonstration programs	To demonstrate the practical implementation of technologies	United Kingdom Inside UK Enterprises Program
Information	To enrich the technology related information resources available to firms	Canada Canadian Technology Network
Workforce training	To upgrade the ability of human capital to identify, absorb and use technology	United Kingdom Local Training and Enterprise Councils
Organizational change	To assist firms in developing innovation-oriented management	Norway Business Development Using New Technology (BUNT)

There are various approaches to technology diffusion. These are the programs that aim at specific targets and the programs that combine to form a technology diffusion system in a country's national innovation system. Technology diffusion targets can be classified as ***technology-specific***, ***institution-specific***, ***sector-specific*** and ***region-specific***. Technology diffusion services can be classified as ***technical assistance***, ***demonstration programs***, ***information***, ***workforce training*** and ***organizational change*** (**OECD**, 1997d).

The characteristics of technology diffusion programs are (**OECD**, 1997d):

a. Programs should be customer-focused and demand-driven,
b. Programs should have broad targets,
c. Programs should provide a range of services,
d. Programs should be integrated,
e. Programs should include hard and soft technologies.

There is another more simplified typology/approach for technology diffusion programs. This typology adopts a four-fold classification of programs according to their operational focus as *supply-driven*, *demand-driven*, *network based* and *infrastructure building*.

Table 4.5 Workshop typology of technology diffusion programs (**OECD**, 1997d)

TYPE OF PROGRAM	PURPOSE	EXAMPLE
Supply-driven	To transfer technology from government research efforts to the private sector	Canada Canadian Space Agency's Space Station Program
Demand-driven	To transfer technologies to meet the specific needs of firms	Unites States Manufacturing Extension Partnership (MEP)
Network-based	To develop bridging institutions and partnerships to promote technology flows	Netherlands Dutch Innovation Centers
Infrastructure-building	To upgrade regional and national technology diffusion infrastructure	Korea Regional Research Centers (RRCs)

All these four types of technology diffusion approaches are practiced in some form in almost all countries. Actually, each country use their own distinctive combination of policies and programs or "***diffusion mix***". The characteristics of this mix reflect not only the features of specific ***National Innovation Systems*** but also competitive position, developmental stage and strategies and regional and industrial dynamics.

4.2.1.2 Information resources

Most of the technology diffusion programs aim to increase the information resources available to institutions, organizations and firms regarding technology trends and technological aids and enhance their ability to acquire such information. Referral services,

technology brokers, firm networks and electronic networks are examples for technology diffusion information programs (**OECD**, 1997d), (**Sabel and the LEED programme**, 1996).

Table 4.6 Technology diffusion information programs (**OECD**, 1997d)

TYPE	PURPOSE	EXAMPLE
Referral services	To reduce technology-related information search costs	Canada Canadian Technology Network
Technology brokers	To mach firms with supply of ready- to-use technologies.	Denmark Danish Technological Institute (DTI) Brokerage Service
Firm networks	To promote alliances among SMEs to facilitate technology diffusion	Belgium PLATO
Electronic networks	To link firms electronically to sources of technical information.	European Union CORDIS

4.2.2 Structural changes

4.2.2.1 Knowledge flow

For policy makers, an understanding of the ***National Innovation System*** can help *identify leverage points* for enhancing innovative performance and overall competitiveness. The structure of knowledge flows and the relative importance of different types of actors differ from country to country. Institutional interactions occur more easily in some countries than in others. Technological innovation takes place within a specific industrial structure and national context and a better understanding of this context/system will lead to better government technology and innovation policies.

Both, ***tacit knowledge***, or know-how exchanged through informal channels, and ***codified knowledge***, or information codified in publications, patents and other sources, are important. Basic knowledge flows among actors can be described as ***interactions among enterprises (joint industry activities)***, ***interactions among enterprises, universities and public research laboratories (public/private sector partnerships)***, ***technology diffusion*** and ***personnel mobility***. Knowledge flows between the public and private sectors can be

measured in a variety of ways, but there are four main techniques. These are ***joint research activities***, ***co-patents and co-publications***, ***citation analysis*** and ***firm surveys***.

Although the national level of knowledge flows are the most important for conceptualizing ***National Innovation System***, the role of international knowledge flows must also be acknowledged. It is a fact that there is an increased openness of ***National Innovation Systems*** with regard to many forms of knowledge flows, including technology acquired from abroad in capital and intermediate goods, purchases of foreign patents and licenses, technical alliances between firms or organizations of different countries, trade in services such as technical consultancies, foreign direct investment and international co-authorized publications (**OECD**, 1997f).

Table 4.7 Core knowledge flows in National Innovation Systems (**OECD**, 1997f)

TYPE OF KNOWLEDGE	MAIN INDICATOR
Industry Alliances	
Inter-firm research co-operation	Firm surveys Literature-based counting
Industry/University Interactions	
Co-operative industry/University R&D Industry/University co-patents Industry/University co-publications Industry use of university patents Industry/University information-sharing	University annual reports Patent record analysis Publications analysis Citation analysis Firms surveys
Industry/research institute interactions	
Co-operative industry/Institute R&D Industry/Institute co-patents Industry/Institute co-publications Industry use of research institute patents Industry/Institute information-sharing	Government reports Patent record analysis Publications analysis Citation analysis Firms surveys
Technology diffusion	
Technology use by industry Embodied technology diffusion	Firm surveys Input-output analysis
Personnel mobility	
Movement of technical personnel among industry, universities and research institutions	Labor market statistics University/Institute reports

4.2.2.2 Stakeholders in the National Innovation System

A ***National Innovation System*** should consist of all individuals and organizations involved in creating and using a knowledge base in order to build a better country. The stakeholders for the ***National Innovation System of Turkey*** can be defined as follows:

a. The Turkish Grand National Assembly National Innovation Commission (TGNANIC) (***Proposed with this study***),
b. Prime Ministry,
c. Turkish General Staff,
d. Supreme Council for Science and Technology,
e. The Scientific and Technical Research Council of Turkey,
f. Turkish Standards Institution,
g. State Institute of Statistics,
h. State Planning Organization,
i. Small and Medium Industry Development Organization / National Productivity Center,
j. Technology Development Foundation of Turkey,
k. The Turkish Industrialists and Businessmen's Association,
l. The Union of Chambers of Commerce, Industry, Maritime Trade and Commodity Exchanges of Turkey,
m. Non-governmental Organizations,
n. Representatives of Universities,
o. Representatives of Government Line Departments,
p. The Media,
q. Local Industrialists and Businessmen's Associations,
r. Representatives of Labor Unions,
s. Representatives of International Firms Working in Turkey.

The principle stakeholders in the ***National Innovation System of Turkey*** and their respective roles are described in the following table (Table 4.8). These stakeholders all play a variety of roles in the system. They may be policy makers or advisors, financiers, regulators, performers of R&D or other related scientific activities, educators or trainers, or

providers of infrastructure. Government is the dominant player and performs some "*core functions*".

4.2.2.3 Grouping the stakeholders according to their roles

We will attempt to group the stakeholders according to their roles in the project as:

a. Controlling organizations,
b. Coordinating organizations and,
c. Executing organizations.

4.2.2.3.1 Controlling organizations

Many people believe that monitoring and project control are one and the same. This is not so. Control is doing something about what the reports show. Control is management, not paperwork. Control involves analyzing the situation, deciding what to do and doing it. But control presupposes that a certain amount of paperwork is to be done. Control is (**Andersen, Grude and Haug**, 1995) :

a. Reporting progress of the project in relation to the plan,
b. Analysis variance between progress and the plan,
c. Taking action to eliminate the variances.

The following can create pitfalls in controlling (**Andersen, Grude and Haug**, 1995) :

a. The project manager and his team do not understand the purpose of the control, they do not understand the difference between monitoring and controlling,
b. The plan and progress report are not integrated,
c. There is no well defined, formalized communication between project manager and project members,
d. The project manager has responsibility, but no formal authority.

Controlling organizations can be defined as;

* *The Turkish Grand National Assembly National Innovation Commission,*
* *The Scientific and Technical Research Council of Turkey.*

4.2.2.3.2 Coordinating organizations

Organizing the use of resources and the work towards goals are very important processes of project work. Coordination is very important in project management. It is a necessity for the global organization of the project. Each process of project work may involve effort from one or more individuals or groups of individuals based on the needs of the project. The work of the project must be integrated with the ongoing operations of the performing organization. A project should include all the work required. For this reason, the role of controlling organizations on project development is very important (**William**, 1987).

Coordinating organizations can be defined as;

* *Turkish General Staff,*
* *Turkish Standards Institutions,*
* *State Institute of Statistics,*
* *State Planning Organization,*
* *Small and Medium Industry Development Organization/National Productivity Center,*
* *Technology Development Foundation of Turkey,*
* *Non-governmental Organizations,*
* *The Media,*
* *Representatives of Labor Unions,*
* *Representatives of International Firms Working in Turkey.*

4.2.2.3.3 Executing organizations

Execution is an important process for successful conclusion. The following can create general pitfalls (**Andersen, Grude and Haug**, 1995):

a. The complexity of coordinating a variety of resources is underestimated,
b. Changes to the plan or specification are uncontrolled,
c. Activities are not completed and documented before others begin,
d. The targets of time, cost and quality are unbalanced.

Executing organizations can be defined as;

* *Prime Ministry,*
* *Supreme Council for Science and Technology,*
* *The Turkish Industrialists and Businessmen's Association,*
* *Representatives of Universities,*
* *Local Industrialists and Businessmen's Associations,*
* *Representatives of Government Line Departments,*
* *The Union of Chambers of Commerce, Industry, Maritime Trade and Commodity Exchanges of Turkey,*

There is not a hierarchical organizational structure among these stakeholders. This proposed systematic structure is only a new combination of existing elements defined in the concept of the ***National Innovation System*** of Turkey. Activities of the stakeholders will be performed on sectoral basis in administrative provinces.

The president of the TGNA is the president of TGNANIC. The government should report the developments about the ***National Innovation System*** of Turkey to this commission within a period of 6 months. The Scientific and Technical Research Council of Turkey's duty is the secretary of the TGNANIC.

MORN is being suggested as a web-based electronic network to use for *communication* and *information infrastructure* among the actors defined in the ***National Innovation System*** of Turkey.

Table 4.8 Stakeholders in National Innovation System of Turkey Project.

STAKEHOLDER	JUSTIFICATION
THE TURKISH GRAND NATIONAL ASSEMBLY NATIONAL INNOVATION COMMISSION (TGNANIC)	Since the owner of National Innovation System Project of Turkey is Turkish people, this project should be closely followed by the Turkish Grand National Assembly (TGNA). TGNA National Innovation Commission **(TGNANIC)** should be formed. This commission should evaluate the developments twice a year. The president of TGNA should chair this commission. The findings of NIS projects in other OECD countries have been used by the parliaments to pass new laws.
PRIME MINISTRY	The Prime Minister presides the Supreme Council for Science and Technology. Prime Ministry should carry out the project .
TURKISH GENERAL STAFF	In order to increase defense power and to lower defense expenditures at the same time, there is a strong need for coordination with the Turkish General Staff in identifying and exploiting innovations developed and introduced in our country.
SUPREME COUNCIL FOR SCIENCE AND TECHNOLOGY	This council should coordinate execution.
THE SCIENTIFIC AND TECHNICAL RESEARCH COUNCIL OF TURKEY	This council is one of the main actors in the project because of its role in scientific and technological research and development work in the country.
TURKISH STANDARDS INSTITUTION	This institution should participate in the project because of its role in forming standards of scientific and technological developments.
STATE INSTITUTE OF STATISTICS	In order to define, collect, diffuse and manage the feedback of new statistical information, this institute should be included in this project.
STATE PLANNING ORGANIZATION	In order to add the project findings to the long-term macro plans, this organization should be included in this project.
SMALL AND MEDIUM INDUSTRY DEVELOPMENT ORGANIZATION / NATIONAL PRODUCTIVITY CENTER	Responsible for disseminating scientific and technological innovations to the small and medium size companies.
TECHNOLOGY DEVELOPMENT FOUNDATION OF TURKEY	TDFT plays an important role in incentive programs for R&D.
THE TURKISH INDUSTRIALISTS AND BUSINESSMEN'S ASSOCIATION	As representatives of big business in the country, their active participation is important.
THE UNION OF CHAMBERS OF COMMERCE, INDUSTRY, MARITIME TRADE AND COMMODITY EXCHANCES OF TURKEY	They will act as liaison offices of the project in the efforts to reach as many companies as possible.
NON-GOVERNMENTAL ORGANIZATIONS	These organizations are the main actors of this project because of their role in the maximization of participation by different social groups.
REPRESENTATIVES OF UNIVERSITIES	As organizations that create information, representatives of universities will assist this project on main branch and sector base.
REPRESENTATIVES OF GOVERNMENT LINE DEPARTMENTS	These are going to present innovation to government organizations and manage feedback.
THE MEDIA	The Media has an important role on diffusing innovation in the country.
LOCAL INDUSTRIALISTS AND BUSINESSMEN'S ASSOCIATIONS	These organizations should be one of the main actors that will support the NIS project in administrative provinces.
REPRESENTATIVES OF LABOR UNIONS	These organizations have an important role on happiness and prosperity of labors in country.
REPRESENTATIVES OF INTERNATIONAL FIRMS WORKING IN TURKEY	These are going to present new technologies and help innovation diffusion in Turkey.

4.2.3 Decisions&interactions and motivations

Innovation and technology diffusion is essentially the widespread adoption of technology by users other than the original innovator. One of the challenges for innovation and technology diffusion is not entirely the defining of best practices or associated tools and methods but their transfer and absorption. For successful technology and innovation diffusion, an "***appetite for change***" should be created among firms, organizations, and institutions by actors in the ***National Innovation System***.

Other important points are ensuring quality control of technology diffusion service providers, using experienced and trained staff and consultants, building on existing resources rather than duplicating new ones, considering how to transfer and license technology, using systematic methods and maintaining close links with industry groups and associations (**OECD**, 1997c), (**OECD**, 1997d).

Some *initiatives* should be defined for ***National Innovation System***. These initiatives may be as follows (**DACST of South Africa**, 1996):

As government functions:

a. Policy Formulation and Resource Allocation,
b. Regulatory Policy,

As shared functions:

a. Performance-Level Financing,
b. Performance,
c. Human Resource Development and Capacity Building,
d. Science and Technology Infrastructure.

Government performs its role in a ***National Innovation System*** by means of a set of functions. Government should create an environment for innovation in the country. Therefore, *innovation-oriented thinking* is very important for a government. At this point, the government;

a. Should establish laws and regulations,
b. Allocate public resources according to a set of priorities which it establishes,

c. And initiate and implement programs related to these functions.

One of the most important features of ***National Innovation System*** is that the actors/participants should interact positively and creatively. Governments should act to optimize the distribution of the resources among the actors. The "*core functions*" of government are ***policy settings***, ***resource allocation at the national level*** and ***legislating regulatory frameworks***.

Acting for innovation is in responsibility of almost all government and non-government organizations, citizens, industry, national, regional and local authorities. As an initial action plan, a limited number of priority initiatives to be launched very soon at community level should be determined by the government. But on the other hand, the government and related organizations/institutions should continue to investigate some of the long-term schemes and define a common reference framework which will help to identify priority options. The action plan for innovation identifies those three areas for action (**IMT**, 1998):

a. To foster an innovation culture,
b. To establish a framework conducive to innovation,
c. To better articulate research and innovation.

Another important feature for government in ***National Innovation System*** is "***Innovation Fund***". The government should establish an *Innovation Fund* which will support large-scale projects, involving participants from the ***National Innovation System.*** The government should always be a minority source of funding innovative activities at the national level.

It is a fact that, same as in European Union, R&D intensity in SMEs is 0.1% in real manner, 0.9% in low level for Turkey and 99% of SMEs do not perform any R&D activities. *Small and Medium Industry Development Organization* should not perform the services for 99% of SMEs that do not perform any R&D activities, but should take on the coordination of services for them. *Technology Development Foundation of Turkey* should not perform but coordinate information and education studies for 0.9% of SMEs in low level as R&D intensity and should support 0.1% of SMEs in real manner as R&D intensity.

4.2.4 External developments

Technological change in an economy is strongly linked to innovation and to technology diffusion. It is known that technological change is a major factor in long-term commercial failure or success. New technologies create new markets. The diffusion of innovations is a slow-moving process that takes place over years. The innovative performance of firms, sectors, regions, institutions, organizations and countries increasingly depends on putting technology to work by adopting and using innovations, products and techniques developed elsewhere.

In general, larger countries obtain less of their acquired technology from abroad than smaller ones, which depend on imports for more than half. However, there are some large countries such as Canada and the United Kingdom which get more than 50 per cent of their acquired technology from abroad. High technology and science-based industries and clusters usually make more use of foreign sources of acquired technology. In most countries, there are a few sectors that are the main "gateways" for acquired technology flows from abroad, e.g. chemicals in Denmark and the Netherlands and motor vehicles in Germany (**OECD**, 1997f).

Table 4.9 Suggested PET framework for National Innovation System of Turkey

TECHNOLOGY	**PRINCIPLES**	Technology diffusion within a specific program to all firms, organizations and institutions.
	CHANGES	Integrated National Innovation System design for country. Organizational innovation for all institutions and organizations. Technological innovation for all firms. Using the linkages among the actors.
STRUCTURAL CHANGES	**TECHNOLOGICAL**	Defining technology diffusion program for country. Coordinating with other countries and organizations.
	ECONOMIC	Economic importance of knowledge. Changing relationships between technology suppliers and users.
	INFORMATIONAL	Promoting an information society. Using effectively the knowledge flows among the actors. Joint research activities. Establishing science and technology infrastructure.
	POLITICAL	Providing safety and security to all who live and work in country. Establishing regulatory policies. Using innovation-oriented thinking. Creating The Turkish Grand National Assembly National Innovation Commission.
DECISIONS & INTERACTIONS **MOTIVATIONS**	**INNOVATION**	The importance of knowledge generation. Developing human resources. Technology and knowledge diffusion. Participation and sharing inside the country. Benchmarking. Collaboration.
	ADOPTION	The provision of infrastructure. Initiate and implement programs. Technology transfer. Organizational change,
	POLITICAL DECISIONS	Action plan. Sharing of the risks. Policy formulation and resource allocation. Establishing laws and regulations.
EXOGENOUS DEVELOP-MENTS	**DEVELOPMENTS IN THE EXTERNAL MARKETS**	Coordination. Collaboration. Technology diffusion.
	INCENTIVE POLICIES	International investments.
	ECONOMICAL GROWTH	Resource allocation.
	PUBLIC OPINION	Information links.

5. SYSTEMS ARCHETYPES AND NATIONAL INNOVATION SYSTEM

National Innovation System is a system made up of different kinds of actors. Like other systems, there are some problems within this system as well. Interrelations among the actors create different kinds of problems. *Systems archetypes* are powerful tools for understanding complex problems within the systems. By using the archetype "*templates*", we can identify similar dynamics occurring in our own organization or system. We can go deeper to the level of systemic structure and begin to see what creates the behaviors. We observe and then take actions to change the structure. Social systems are more complex and harder to understand than technological systems. The more we build our understanding of system behavior, the more we can anticipate that behavior and work with the system to shape the quality of our lives. In this way, we can shape the future of our system (**Forrester**, 1995).

5.1 Review of Systems Thinking and System Dynamics Concept

Systems thinking is a new way of thinking. It offers a valuable new perspective on our mostly continuous organizational problems. By way of *systems thinking,* we can identify more effective ways of addressing repeating difficulties. We should know that all systems are parts of larger systems.

The characteristics of *systems thinking* are (**Anderson, Lauren**, 1998);

a. Thinking of the *"big picture"*.
b. Balancing short-term and long-term perspectives.
c. Recognizing the dynamic, complex and interdependent nature of systems.
d. Taking into account both measurable and nonmeasurable factors.
e. Remembering that we are all part of the systems in which we function and that we each influence those systems even as we are being influenced by them.

We can define the *system's behavior* by way of systems thinking. It stresses looking at wholes rather than parts and emphasizes the role of interconnections. This means that we are viewing and studying the entire system. We should look for and determine *leverage points* within a system. Leverage points are places where a slight change will have a

tremendous effect on the system's behavior. We should avoid solutions that consider only the symptoms of the underlying problem (**Cover**, 1996).

System dynamics is a decision making process based on *patterns of behavior* over time. Knowing that variables are connected to one another is not enough for understanding systems. We need to know how they are connected and how they affect the other's behavior. In another way, we should to know the structure of the system. All the problems about the system are inside the system. Everything we need to know is inside the system. But we should not forget that systems are often subsystems of larger systems. We can model problems not systems by way of system dynamics. Consequently, we can understand the patterns of behavior in the system.

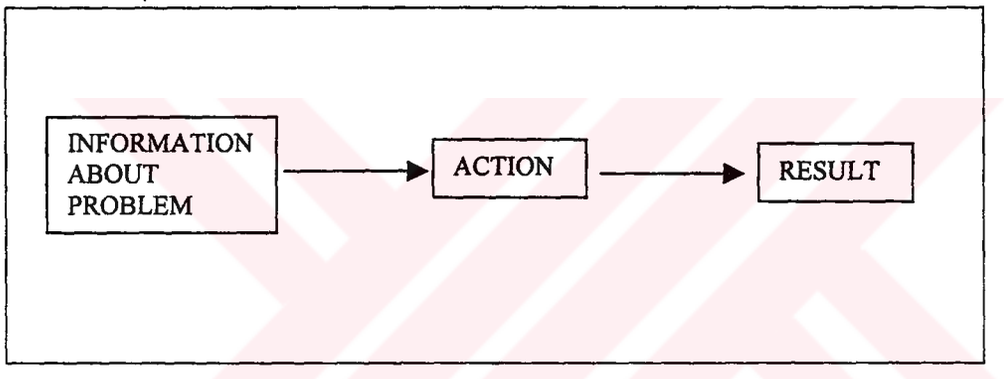

Figure 5.1 Open-loop impression of the world (**Forrester**, 1996).

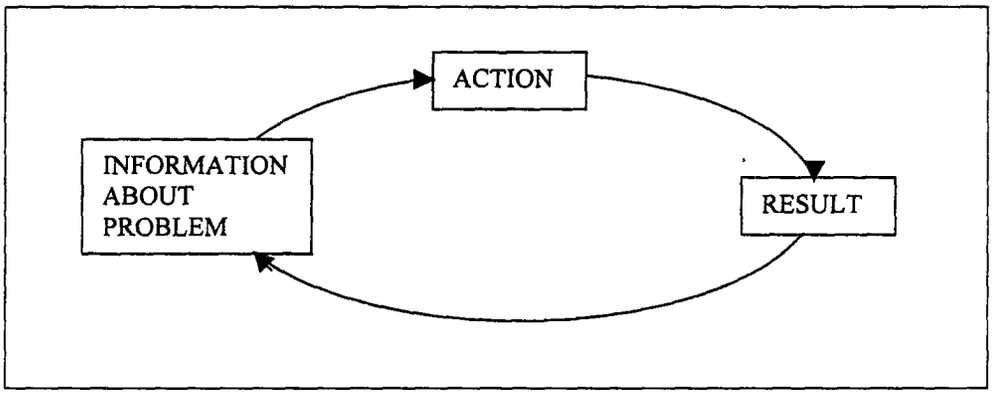

Figure 5.2 Closed-loop structure of the world (**Forrester**, 1996).

We try to solve the problems in a linear way almost all the time. Generally, we do not consider feedback. But, by way of system dynamics, we consider *feedback loops*. So, we

can have more realistic perception. Feedback loops are the structures within which all changes occur in the system. Until one understands the dynamic cause of present undesirable conditions, one is not prepared to explore moving from present conditions to more desirable conditions (**Forrester**, 1994), (**Forrester**, 1996).

5.2 Analysis of "National Innovation System" Concept using Well Known Systems Archetypes

Systems thinking offers a range of tools from **casual loop diagrams** to more complex tools such as **computer simulation models** and **designed learning environments** for obtaining deeper insight into problems. There are at least ten distinct types of systems thinking tools. They are categorized as *brainstorming tools*, *dynamic thinking tools*, *structural thinking tools* and *computer based tools*.

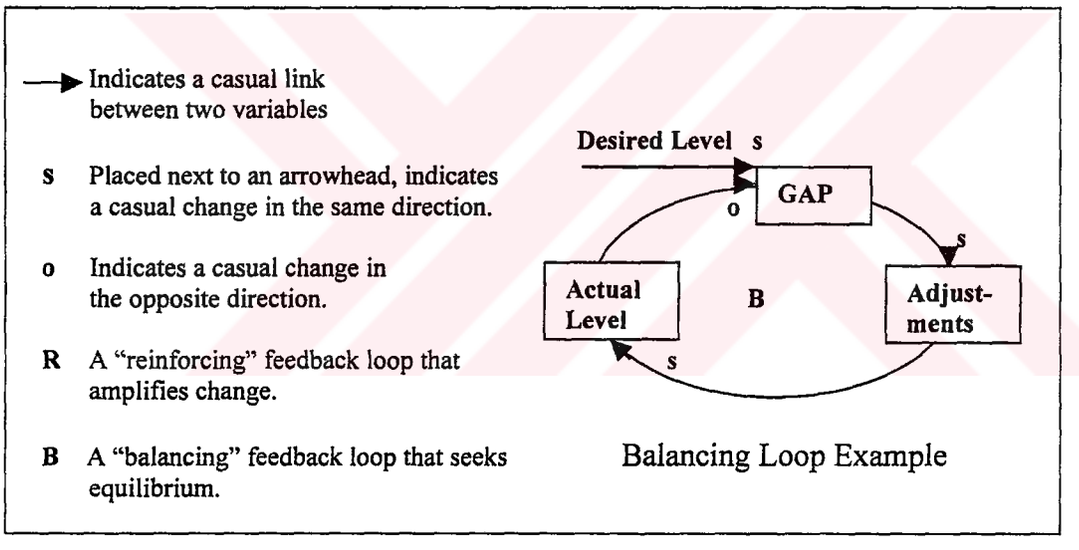

Figure 5.3 The language of links and loops (**Kim**, 1994).

Systems Archetypes is a dynamic thinking tool. Dynamic interrelationships are represented by *Casual Loop Diagrams* (CLDs). These archetypes consist of various combinations of *balancing* and *reinforcing loops*. ***"Drifting Goals"***, ***"Shifting the Burden"***, ***"Limits to Success"***, ***"Success to the Successful"***, ***"Fixes that Fail"***, ***"Tragedy of the Commons"***, ***"Growth and Underinvestment"*** and ***"Escalation"*** are specific archetypes (**Kim**, 1994), (**Barlas**, personal communication).

5.2.1 Drifting goals

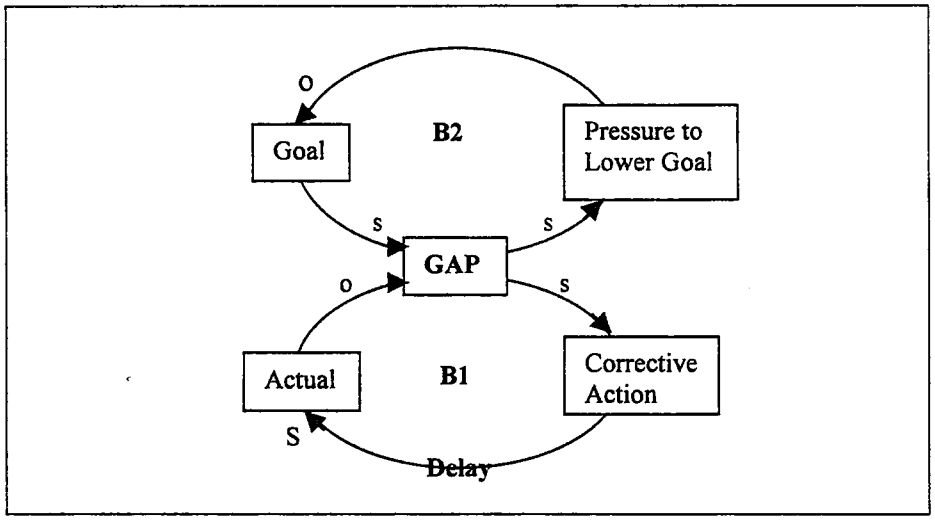

Figure 5.4 Drifting goals template

5.2.1.1 Definition

The *Drifting goals* structure is composed of two balancing loops which interact in such a way that the activity of one loop actually undermines the intended balance the other one seeks to achieve.

Description

In a *"Drifting goals"* archetype, a gap between the goal and current reality can be resolved by taking corrective action (B1) or lowering the goal (B2). The critical difference is that lowering the goal immediately closes the gap, whereas corrective actions usually take time.

Guidelines

- Drifting performance figures are usually indicators that the *"Drifting goals"* archetype is at work and that real corrective actions are not being taken.
- A critical aspect of avoiding a potential *"Drifting goals"* scenario is to determine what drives the setting of the goals.
- Goals located outside the system will be less susceptible to drifting goals pressure (**Kim**, 1994).

5.2.1.2 The well-known application of this archetype

The well-known application of this archetype is "*staying focused on vision*". Various pressures can often take our attention away from what we are trying to achieve. The "*Drifting goals*" archetype helps to explain why an organization is not able to achieve its desired goals. Used as a diagnostic tool, it can target drifting performance areas and help organizations attain their vision (**Kim and Lannon,** 1997).

Seven steps for this archetype are (**Kim and Lannon**, 1997):

1. Identify drifting performance measure.
2. Look for goals that conflict with the stated goal.
3. Identify standard procedures for closing the gap. Are they inadvertently contributing to the goal slippage?
4. Examine the past history of the goal. Have the goals themselves been lowered over time?
5. Anchor the goal to an external reference.
6. Clarify a compelling vision that will involve everyone.
7. Create a clear transition plan. Explore what it will take to achieve the vision, and establish a realistic timeline.

5.2.1.3 Discussion of "*National Innovation System*" from the perspective of this archetype

Managing the ***National Innovation System*** needs a ***methodology***. The goal is a methodology, but in actuality, ***there is not a specific methodology*** for managing ***National Innovation System*** of Turkey. Goal or desired state (having methodology) interacts with the actual state (having no methodology). This situation produces a *gap*. This gap influences corrective action intended to move the actual state in the direction of the goal. But at the same time, this pressure essentially acts as an influence to reduce the goal. This means that we try to set up ***National Innovation System*** without using a specific methodology. As the goal is undermined it works to reduce the gap lessening the influence

toward corrective action. The final result of this structure is that it reaches an equilibrium other than what was the initial desired state or goal.

Organizations or enterprises aim to increase the funds allocated to R&D. But, both managers and owners of enterprises do not want to allocate money for R&D and want these kind of issues to be done by the government. The reason for not allocating money for R&D is that they are not enlightened about the importance of fund allocation for R&D for their organizations or enterprises. Because of the culture "*to expect everything from state*", they do not want to expend money for this purpose.

5.2.2 Escalation

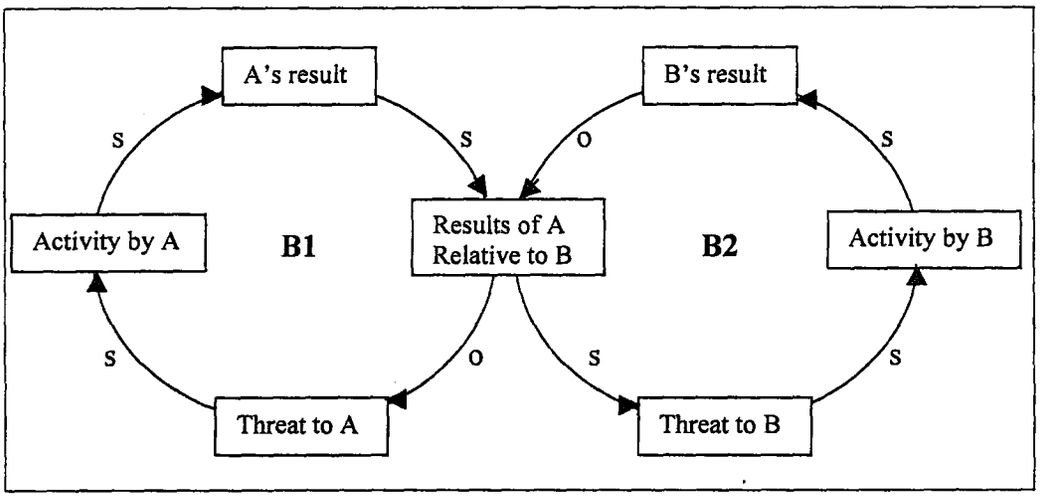

Figure 5.5 Escalation template

5.2.2.1 Definition

An *Escalation* structure is composed of two balancing loops which interact in such a way as to create a single reinforcing loop.

Description

In a *"Escalation"* archetype, one party (A) takes actions that are perceived by the other as a threat. The other party (B) responds in a similar manner, increasing the threat to A and resulting in *more* threatening actions by A.

Guidelines

To break an escalation structure, ask the following questions:

- What is the relative measure that pits one party against the other and can you change it?
- What are the significant delays in the system that may distort the true nature of the threat?
- What are the deep-rooted assumptions that lie beneath the actions taken in response to the threat? (**Kim**, 1994)

5.2.2.2 The well-known application of this archetype

The well-known application of this archetype is "*competition*". One of the reasons we get caught in escalation dynamics may stem from our view of competition. The "*Escalation*" archetype suggests that cutthroat competition serves no one well in the long run. The archetype provides a way to identify escalation structures at work and shows how to break out of them or avoid them altogether (**Kim and Lannon**, 1997).

Seven steps for this archetype are (**Kim and Lannon**, 1997):

1. Identify the competitive variable. Is a single variable the basis of differentiation between competitors?
2. Name the key players caught in the dynamic.
3. Map what is being threatened. Are your company's actions addressing the real threat, or simply preserving core values that may no longer be relevant.
4. Reevaluate competitive measure. Can the variable that is the foundation of the game (price, quality, etc.) be shifted?
5. Quantify significant delays that may be distorting the nature of the threat.
6. Identify a larger goal encompassing both parties' goals.
7. Avoid future "*Escalation*" traps by creating a system of collaborative competition.

5.2.2.3 Discussion of "*National Innovation System*" from the perspective of this archetype

An institution or organization may want to get some kind of information from a government unit. This effort may be perceived by the party having the information as a threat and they respond by not sharing information, trying to block the study of the requesting side, starting the same kind of study themselves. Of course, the party that wanted to get information in the beginning feels threatened. An unexpected hostility among the parties emerges. Generally, government and non-government organizations communicate poorly both among themselves and with each other. This situation can be explained by the "*Escalation*" template.

5.2.3 Fixes that fail

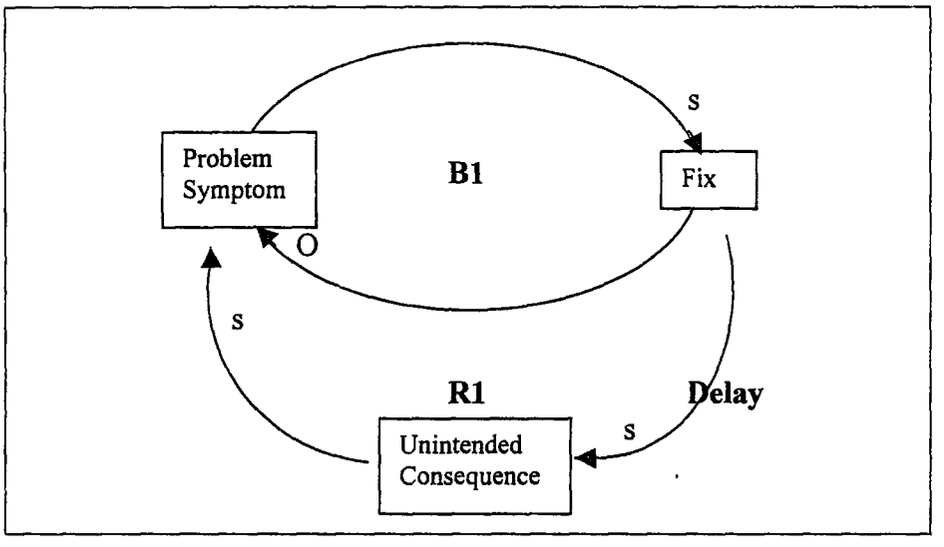

Figure 5.6 Fixes that fail template

5.2.3.1 Definition

The *Fixes that fail* structure consists of a balancing loop and a reinforcing loop.

Description

In a "*Fixes that fail*" situation, a problem symptom cries out for resolution. A solution is quickly implemented that alleviates the symptom (B1), but the unintended consequences of the "fix" exacerbate the problem (R1). Over time, the problem symptom returns to its previous level or becomes worse.

Guidelines

- Breaking a *"Fixes that fail"* cycle usually requires acknowledging that the fix is merely alleviating a symptom and making a commitment to solve the real problem now.
- A two-pronged attack of applying the fix and planning out the fundamental solution will help ensure that you don't get caught in a perpetual cycle of solving yesterdays "solutions" (**Kim**, 1994).

5.2.3.2 The well-known application of this archetype

The well-known application of this archetype is "*problem solving*". Almost any decision carries long-term and short-term consequences, and the two are often diametrically opposed. The "*Fixes that fail*" archetype can help you get off the problem-solving treadmill by identifying fixes that may be doing more harm than good (**Kim and Lannon**, 1997).

Seven steps for this archetype are (**Kim and Lannon**, 1997):

1. Identify problem symptom.
2. Map current interventions and how they were expected to rectify the problem.
3. Map unintended consequences of the interventions.
4. Identify fundamental causes of the problem symptoms.
5. Find connections between both set of loops. Are the fixes and the fundamental causes linked?
6. Identify high-leverage interventions. Add or break links in the diagram to create structural interventions.
7. Map potential side-effects for each intervention in order to be prepared for them (or to avoid them altogether).

5.2.3.3 Discussion of "*National Innovation System*" from the perspective of this archetype

This archetype is a "*quick-fix*" solution. Generally, temporary solutions are applied in case of a problem symptom in government organizations. But they are not usually aware of the negative consequences of applying a quick-fix. It should be known that solving one problem today in a temporary manner would create another one tomorrow. This negative situation does delay innovative performance of government organizations. For example; to import diesel oil from Northern Iraq is allowed in order to support the economic development in Southeast Anatolia. But, this created income is flowing to undesired person or groups. This situation naturally effects the other distribution companies in Turkey negatively. "*To trade without tax*" disrupts the primary principle of a state which

is "*to pay taxes for covering common needs*" and this leads to misconception of state understanding. But it should not be forgotten that solving the problem in an unplanned way would create major problems in the future.

Another example for this archetype can be given from natural environment. As it is very well known that environmental pollution has reached its peak currently. Lack of influential policies, ineffective law enforcement concerning this issue and not being able to get to the roots of the problem has made the destruction into a traditional problem. The destruction caused reaches extraordinary points before the state realizes and to restore the environment becomes more expensive than the previous precautions that could have been taken. This reaches a point as to prevent investments in other areas.

One more example concerning this archetype can be given from enterprises. A person or a machine seen as the cause of low productivity can be fired or replaced and this type of precaution might bring a temporary solution to the problem. However, this type of unplanned and rootless actions will increase the severity of the problems. The person fired might not actually be the cause of the problem and this in return will have negative side effects over the other employees such as lack of motivation. Likewise the misplacement of a machine will lead to a wasteful investment. This situation can also retard innovative performance within the enterprise.

5.2.4 Growth and underinvestment

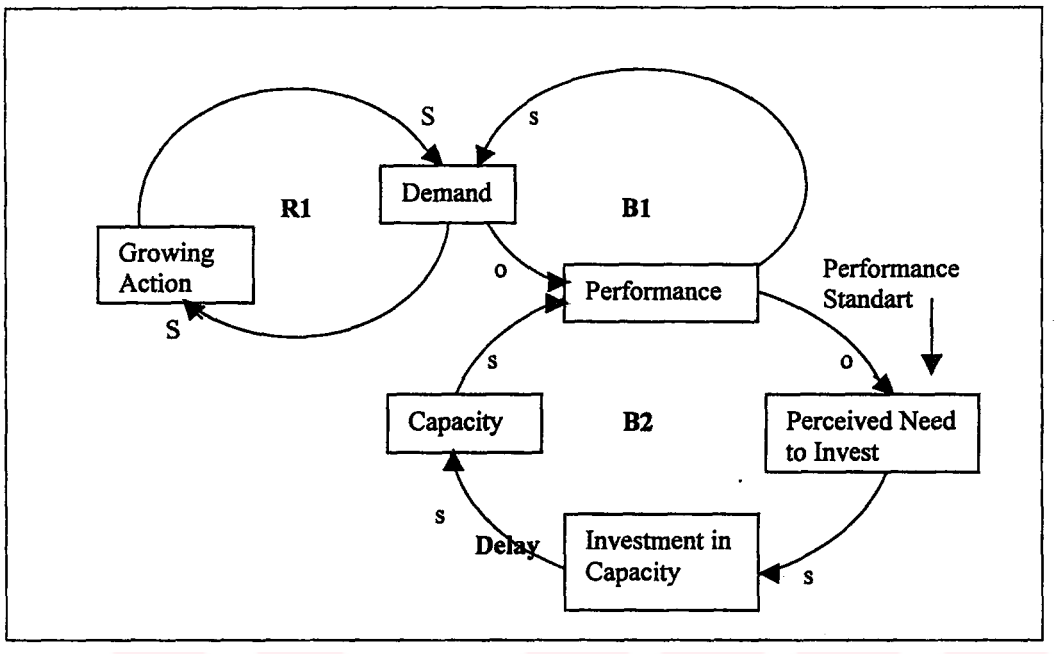

Figure 5.7 Growth and underinvestment template

5.2.4.1 Definition

The *Growth and underinvestment* structure consists of two balancing loops and a reinforcing loop.

Description

In a *"Growth and underinvestment"* archetype, growth approaches a limit that can be eliminated or pushed into the future if capacity investments are made. Instead, performance standards are lowered to justify underinvestment, leading to lower performance which further justifies underinvestment.

Guidelines

- Dig into the assumptions which drive capacity investment decisions. If past performance dominates as a consideration, try to balance that perspective with a fresh look at demand and the factors that drive its growth.
- If there is a potential for growth, build capacity in anticipation of future demand (**Kim**, 1994).

5.2.4.2 The well-known application of this archetype

The well-known application of this archetype is "*capital planning*". If demand outstrips capacity, performance can suffer and hurt demand. If this dynamic is not recognized, the decrease in demand can then be used as a reason not to invest in the needed capacity. "*Growth and underinvestment*" can be used to ensure that investment decisions are viewed from a fresh perspective, rather than from a reliance on past decisions (**Kim and Lannon**, 1997).

Seven steps for this archetype are (**Kim and Lannon**, 1997):

1. Identify interlocked patterns of behavior between capacity investments and performance measures.
2. Identify delays between when performance falls and when additional capacity comes on-line – particularly perceptual delays regarding the need to invest.
3. Quantify and minimize acquisition delays.
4. Identify related capacity shortfalls. Are other parts of the system too sluggish to benefit from added capacity?
5. Fix investment decisions on external signals, not on standards derived from past performance.
6. Avoid self-fulfilling prophecies. Challenge the assumptions that drive capacity investment decisions.
7. Search for diverse investment inputs. Seek new perspectives on products, services, and customer requirements.

5.2.4.3 Discussion of "*National Innovation System*" from the perspective of this archetype

Capacity planning is very important for both government and non-government organizations. In general there is an ongoing problem of ineffective distribution of resources among public institutions and organizations. This situation holds true for local governments as well. For instance, inconvenient development programs which disregards the reality of a region such as the potential development pace, leads to a flow of capital to

other regions. The East and Southeast Anatolia regions are good examples to this case. While pro-government local governments receive the greater portion of the capital, the others receive inefficiently. This unfair distribution of resources disrupts the innovative performance of the region and thus the performance of the country as a whole.

In a similar way, in order to improve the service quality of Social Insurances Institution/State hospitals there is a need for investment. However, the intention of bureaucrats to serve the "*average needs*" leads to a decrease in "*average service level*" and because the part of the society benefiting from these services has a low voice in politics, problems remain unsolved. Unfortunately, when a certain threshold is passed in such problems, the solution of the problem becomes impossible with existing resources.

5.2.5 . Limits to success

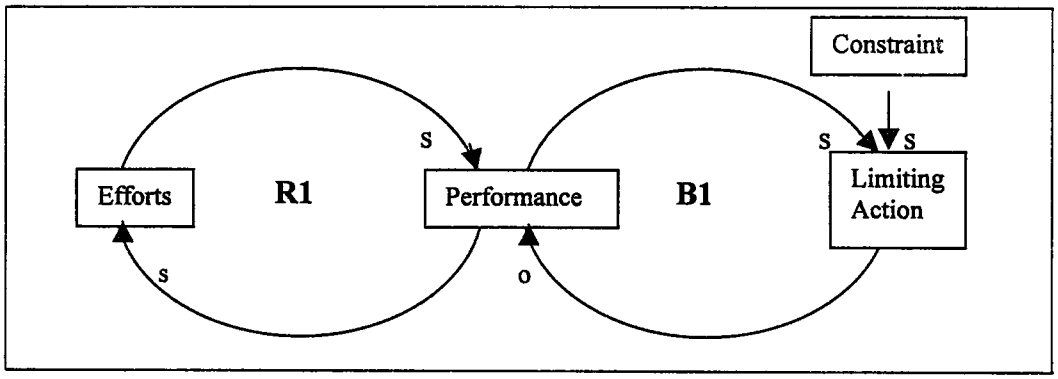

Figure 5.8 Limits to success template

5.2.5.1 Definition

The *Limits to success* structure consists of a reinforcing loop and a balancing loop.

Description

In a "*Limits to success*" scenario, continued efforts initially lead to improved performance. Over time, however, the system encounters a limit which causes the performance to slow down or even decline (B1), even as efforts continue to rise.

Guidelines

- The archetype is most helpful when it is used well in advance of any problems, to see how the cumulative effects of continued success might lead to future problems.
- Use the archetype to explore questions such as "What kind of pressures are building up in the organization as a result of the growth?"
- Look for ways to relieve pressures or remove limits *before* an organizational gasket blows (**Kim**, 1994).

5.2.5.2 The well-known application of this archetype

The well-known application of this archetype is "*planning*". If we don't plan for limits, we are planning for failure. The "*Limits to success*" archetype shows that being successful can be just as dangerous to long-term health as being unsuccessful. By mapping out the growth engines and potential danger points in advance, we can anticipate future problems and eliminate them before they become a threat (**Kim and Lannon**, 1997).

Seven steps for this archetype are (**Kim and Lannon**, 1997):

1. Identify the growth engines.
2. Determine doubling time of those processes.
3. Identify potential limits and balancing loop(s) – physical capacity, information systems, personal, management expertise, attitudes/mental models.
4. Determine change required to deal effectively with the limit(s) identified.
5. Assess time needed to change. Is there a discrepancy between the doubling time and the changes that need to be made to support that growth?
6. Balance the growth. What strategies can be used to balance the growth engine with the time frame of the investments that must be made to sustain it?
7. Reevaluate the growth strategy. Continually challenge assumptions in context of the broader company.

5.2.5.3 Discussion of "*National Innovation System*" from the perspective of this archetype

The archetype hypothesizes that continuing efforts will produce diminishing returns as one approaches the limit. Application of this archetype is *planning*. Planning function is very important for ***National Innovation System***. If we don't plan for limits, we are planing for failure. Cumulative effects of continued success may lead to future problems. We should see this situation in advance. Otherwise, it may be too late to apply a fix.

Due to inappropriate planning and management of investments both in public and private sectors, our national resources are wasted and thus the development process of the country

is impeded. All sectors must take into consideration the concept of *People-System-Organization* ***(P-S-O)*** while planning projects. This will prevent the possible problems that can occur in the future. Innovative performance will not be negatively influenced.

This archetype, which provides us with clues of the problems that might occur in the future, can be used in the effective and productive management of the Southeastern Anatolia Project. We need to do advance planning on the areas where development limits may be reached and on the timing when that limit will be reached.

The structural limits that might occur while increasing export to the aimed point must be investigated and shared with concerned parties.

5.2.6 Shifting the burden/addiction

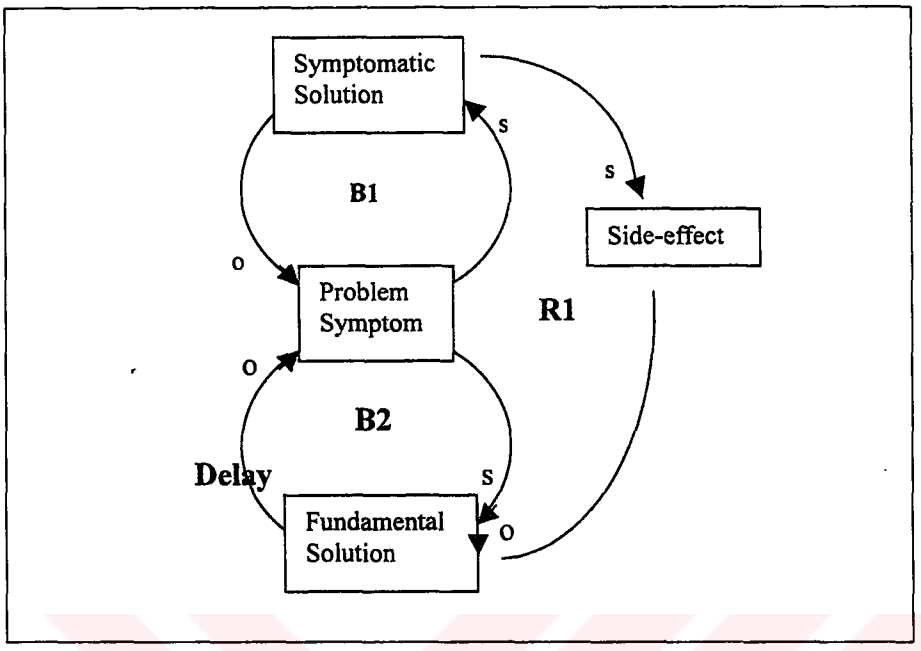

Figure 5.9 Shifting the burden/addiction template

5.2.6.1 Definition

A *Shifting the burden* structure is composed of two balancing loops and a reinforcing loop.

Description

In a *"Shifting the burden"*, a problem is "solved" by applying a symptomatic solution (B1) which diverts attention away from more fundamental solutions (R1). In a "Addiction" structure, a *"Shifting the burden"* degrades into an addictive pattern in which the side-effect gets so entrenched that it overwhelms the original problem symptom.

Guidelines

- Problem symptoms are usually easier to recognize than the other elements of the structure.
  If the side-effect has become the problem, you may be dealing with an "Addiction" structure.
- Whether a solution is "symptomatic" or "fundamental" often depends on one's perspective. Explore the problem from differing perspectives in order to come to a more comprehensive understanding of what the fundamental solution may be (**Kim**, 1994).

5.2.6.2 The well-known application of this archetype

The well-known application of this archetype is "*breaking organizational gridlock*". Organizational gridlock can be caused by interlocking "*Shifting the burden*" structures, as one function's "*solution*" creates problems in another area. The archetype provides a starting point for breaking gridlock by identifying chains of problem symptoms and solutions that form walls between functions, departments, or divisions (**Kim and Lannon**, 1997).

Seven steps for this archetype are (**Kim and Lannon**, 1997):

1. Identify the original problem symptom(s).
2. Map all "*quick fixes*" that appear to be keeping the problems under control.
3. Identify impact on others. What are the impacts of those "*solutions*" on other players in the company?
4. Identify fundamental solutions. Look at the situation from both perspectives to find a systematic solution.
5. Map side-effects of quick fixes that may be undermining the usability of the fundamental solution
6. Find interconnections to fundamental loops. Find the links between the interaction effects and the fundamental solution that may be creating the gridlock.
7. Identify high-leverage actions from both perspectives.

5.2.6.3 Discussion of "*National Innovation System*" from the perspective of this archetype

"*Quick fix*" solutions are not good in the long run. These kinds of solutions appear to be keeping the problem under control. Generally, "*quick fix*" solutions are very common in government organizations. But, instead of quick fix solutions, fundamental solutions should be sought. Government organizations should look at the situation from both perspectives to find a systematic solution.

The procedures applied within the hierarchic structure of public institutions and organizations towards solving the various problems that occur suits the structure of this

archetype. Because the problem is not investigated in depth and from other perspectives, immediate precautions and solutions are always directed towards the first symptoms of the problem. The immediate actions produce negative side effects. Bad functioning of the decision making process within the public institutions and organizations can be given as an example to this case. Participation is neglected, different views are disregarded and hasty actions taken by the managers result with unhealthy decisions. This situation might lead to unrepairable problems in the future.

The relationship between the central government and local governments can also be investigated within the frame of this archetype. The belief that local governments "*do not have the required qualification*" makes the central bureaucracy take all the burden. On the other hand, local governments are unable to carry out "*qualification development process*" with the current resources. In solving problems, local governments are unable to break the chains of "*dependency to the center*".

5.2.7 Success to the successful

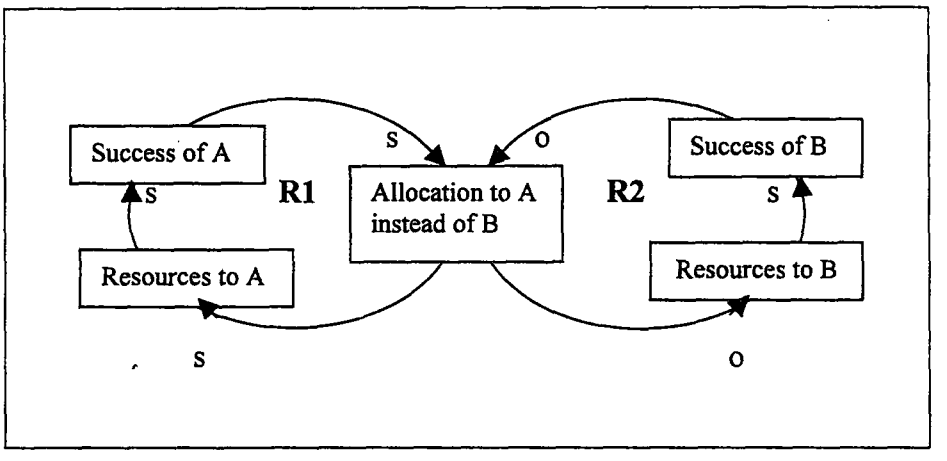

Figure 5.10 Success to the successful template

5.2.7.1 Definition

The *Success to the successful* structure consists of two reinforcing loops which act together as a single reinforcing loop.

Description

In a "*Success to the successful*" archetype, if one person or group (A) is given more resources, it has a higher likelihood of succeeding than B (assuming they are equally capable). The initial success justifies devoting more resources to A than B (R1). As B gets less resources, its success diminishes, further justifying more resource allocation to A (R2).

Guidelines

- Look for reasons why the system was set up to create just one "winner".
- Chop off one half of the archetype by focusing efforts and resources on one group, rather than creating a "winner-take-all" competition.
- Find ways to make teams collaborators rather than competitors.
- Identify goals or objectives that define success at a level higher than the individual players A and B (**Kim**, 1994).

5.2.7.2 The well-known application of this archetype

The well-known application of this archetype is "*avoiding competency traps*". The "*Success to the successful*" archetype suggests that success or failure may be due more to initial conditions than intrinsic merits. It can help organizations challenge their success loops by "*unlearning*" what they are already good at in order to explore new approaches and alternatives (**Kim and Lannon**, 1997).

Seven steps for this archetype are (**Kim and Lannon**, 1997):

1. Investigate historical origins of competencies.
2. Identify potential competency traps.
3. Evaluate current measurement systems – are they set up to favor current systems over other alternatives?
4. Map internal view of market success. What are the operating assumptions around success in the market?
5. Obtain external views of market success. Ask "*outsiders*" for alternative strategies.
6. Assess effects on the innovative spirit. Is the current system excluding or limiting the spirit of experimentation that will lead to new alternatives?
7. Continually scan for gaps and areas for improvement.

5.2.7.3 Discussion of "*National Innovation System*" from the perspective of this archetype

Organizations should be open to competition. Exploring new approaches and alternatives are very important for improvement. The effects on the innovative spirit should be assessed. If one person or group is given more resources, it has a higher likelihood of succeeding than the other (assuming they are equally capable).

Investment policies that differ from region to region in Turkey can be given as an example for this archetype. Lack of investment in East and Southeast Anatolia regions compared to other regions, excess of unemployment ratio, insufficiency of infrastructure, education and culture investments are good example for this template. It can be said that there is a big

gap concerning investment and resource allocations between East and Southeast Anatolia compared to other regions because of wrong policies of governments. This situation creates a wrong and unequal competition. However, all the policies that are defined by the governments should provide same performance and capacity development for all regions in Turkey. Incentive demands from government by the firms located western part of Turkey should be reduced for favor of the firms that are located eastern part of Turkey. Only in this manner equal competition environment can be established.

5.2.8. Tragedy of the commons

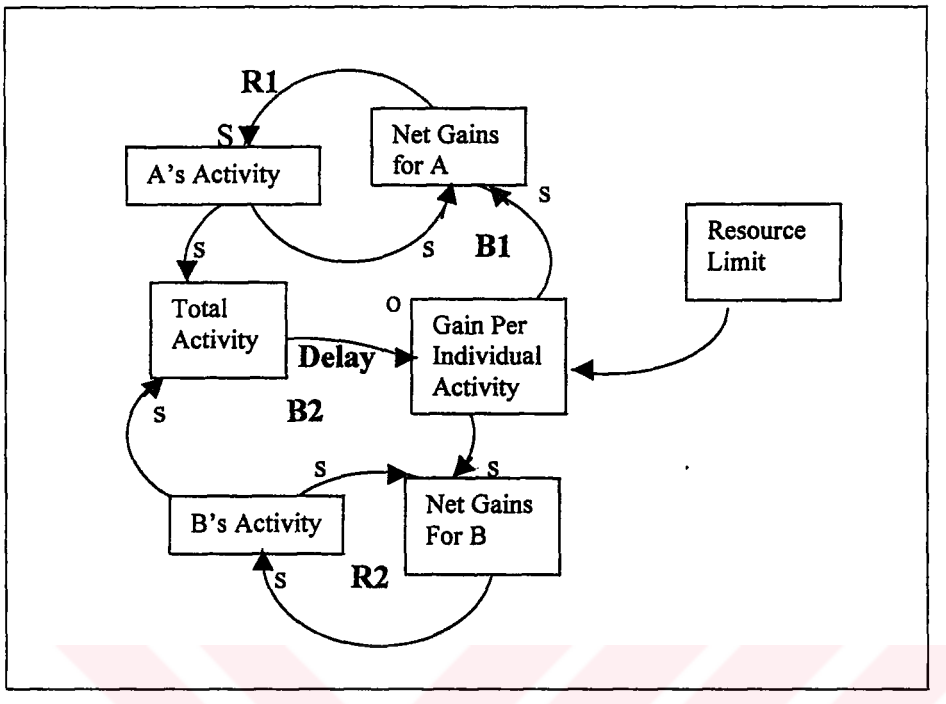

Figure 5.11 Tragedy of the commons template

5.2.8.1 Definition

The *Tragedy of the commons* structure consists of two reinforcing loops and two balancing loops.

Description

In a *"Tragedy of the commons"* structure, each person pursues actions which are individually beneficial (R1 and R2). If the amount of activity grows too large for the system to support, however, the "commons" becomes overloaded and everyone experiences diminishing benefits (B1 and B2).

Guidelines

- Effective solutions for a *"Tragedy of the commons"* scenario never lie at the individual level.
- Ask questions such as: "What are the incentives for individuals to persist in their actions?", "Can the long-term collective loss be made more real and immediate to the individual actors?"
- Find ways to reconcile short-term individual rewards with long-term cumulative consequences. A governing body that is chartered with the sustainability of the resource limit can help (**Kim**, 1994).

5.2.8.2 The well-known application of this archetype

The well-known application of this archetype is "*resource allocation*". In a "*Tragedy of the commons*" situation, the complex interaction of individual actions produces an undesirable collective result, such as the depletion of a common resource. The archetype can be used to help connect the long-term effects of individual actions to the collective outcome, and develop measures for managing the common resource more effectively (**Kim and Lannon**, 1997).

Seven steps for this archetype are (**Kim and Lannon**, 1997):

1. Identify the "*commons*". What is the common resource that is being shared?
2. Determine incentives. What are the reinforcing processes that are driving individual use of the resource?
3. Determine time frame for reaping benefits.
4. Determine time frame for experiencing cumulative effects of the collective action.
5. Make the long-term effects more present. How can the long-term loss or degradation of the commons be more real and present to the individual users?
6. Reevaluate the nature of the commons. Are there other resources or alternatives that can be used to remove the constraint upon the commons?
7. Limit access to resources. Determine a central focal point – a shared vision, measurement system, or final arbiter – that allocates the resource based on the needs of the whole system.

5.2.8.3 Discussion of "*National Innovation System*" from the perspective of this archetype

Resource allocation is vital for organizations. Common resource that is being shared must be identified. Individual actions must be controlled. Otherwise, they produce undesirable collective results.

Awards of contract in public sector basis can be given as example for this archetype. Developments resulted in point of any unit or group can reduce overall efficiency in the long run.

Incentives that are provided to firms are comprehensive. Governments try to give incentive to every firm or everybody. Because of the scope of incentives are not narrow, the importance of incentives are lowered.

Demands about reducing inflation from different sectors are not evaluating as a whole by the government. Precautions against inflation, results of these precautions and effects of these on different sectors of community should be explained better to people.

6. MANAGING THE NATIONAL INNOVATION SYSTEM (NIS) OF TURKEY USING GOAL DIRECTED PROJECT MANAGEMENT METHODOLOGY

Managing the "***National Innovation System of Turkey project***" needs a methodology. This project should be managed in "***P-S-O way of thinking***". Goal Directed Project Management (***GDPM***) presents methods and tools which increase significantly the probability of success and shows how a project can be guided towards achieving its goals using "***P-S-O way of thinking***" (**Andersen, Grude** and **Haug,** 1995).

The management of the ***National Innovation System of Turkey project*** is described in the following sections using ***GDPM methodology***.

6.1 Project Mandate

Project mandate is a form of description of the important aspects of the project. The most common elements of the project mandate is (**Andersen, Grude and Haug,** 1995):

a. The name of the project.
b. The sponsor or the client of the project.
c. Background information.
d. The objectives of the project.
e. The goals of the project.
f. Limitations on the project.
g. Budget.

A sample project mandate for the management of the ***National Innovation System of Turkey project*** is given on the next page.

PROJECT MANDATE :

The name of the Project :

National Innovation System of Turkey.

The sponsor or the client of the project:

The main sponsor of this project is the Turkish people. TGNA has an important role on execution of this project with the coordination of the project members. This project consists of all individuals and organizations involved in creating and using a knowledge base in order to build a better Turkey. The actors/stakeholders of the project are:

a. The Turkish Grand National Assembly National Innovation Commission (TGNANIC) (***Proposed with this project***),
b. Prime Ministry,
c. Turkish General Staff,
d. Supreme Council for Science and Technology,
e. The Scientific and Technical Research Council of Turkey,
f. Turkish Standards Institution,
g. State Institute of Statistics,
h. State Planning Organization,
i. Small and Medium Industry Development Organization / National Productivity Center,
j. Technology Development Foundation of Turkey,
k. The Turkish Industrialists and Businessmen's Association,
l. The Union of Chambers of Commerce, Industry, Maritime Trade and Commodity Exchanges of Turkey,
m. Non-governmental Organizations,
n. Representatives of Universities,
o. Representatives of Government Line Departments,
p. The Media,
q. Local Industrialists and Businessmen's Associations,

r. Representatives of Labor Unions,

s. Representatives of International Firms Working in Turkey.

Background information:

The project, *"National Innovation Project – Technological Change and Monitoring Innovation Processes in Turkish Manufacturing Industry"* supported by Prime Ministry and with participation of *STRCT*, *TDFT*, *SIS*, *SMIDO* and *TPI*, has begun in January 1998. This project has a rather narrow scope since it is focused only on manufacturing industry. Defining this project within the larger scale of the "***National Innovation System***" would yield much better results.

The objectives of the project:

This project is a more system-oriented evaluation approach of the ***National Innovation System*** of Turkey. The objective of this project is not to provide a complete theoretical analysis. It is to form a framework of the applicability of the concept of the ***National Innovation System*** and to explore and initiate a discussion on the future of science and technology policy in Turkey. This project is an opportunity to have a critical glance at the characteristics of ***National Innovation System*** for Turkey.

The goals of the project:

The goals of **"National Innovation System (NIS) of Turkey"** project can be defined as follows:

a. Inducing increases in government and non-government organizations' investments in the fields of science and technology to improve and develop scientific and technological competencies of Turkish people.

b. Forming a strategy for the scientific development of Turkey in strategic, economic and social fields.

c. Increasing enterprises' productivity.

d. Forming and developing of communication among non-government organizations, firms, universities, and government organizations.

Limitations on the project:

The most important aspects of the project are *diffusion* and *sharing* information. The more the information is shared, the more it's activity is going to increase. We must take all important factors shaping and influencing innovation into account for describing, understanding, explaining and influencing processes of innovation.

Budget:

There is not a specific budget for this project at the beginning phase.

6.2 Milestone Plan

A milestone is a description of the *state* the project should be in at a certain stage. Milestones are checkpoints in the project which enable us to ensure that we are on the right track. A milestone plan consists of several milestones and show the dependencies between them (**Andersen, Grude** and **Haug,** 1995).

In most projects not all project members are accustomed to thinking in terms of *states*. People are usually most concerned with activities. Therefore, awareness is required when formulating milestones so that there is a real focus on states which are neutral with regard to the solution.

A milestone plan is a logical plan. It shows the logical dependencies relevant to the current project work. In order to reach a specific milestone, a series of activities must have been completed. You do not need to wait until the previous milestone has been reached before starting to work on another. But it may sometimes be the case that work on the next milestone cannot begin before the previous one has been reached. A milestone text may often be comprised of two elements; the state to be achieved and conditions necessary to achieve the state. A milestone should be controllable and important decision-making points in the project should be milestones. The series of milestones which are especially closely connected to each other are named as *result path.* A result path is formed by milestones which all contribute to the creation of a certain result (**Andersen, Grude** and **Haug,** 1995).

Sample milestone plan of ***National Innovation System of Turkey*** project is on the next page.

Table 6.1 Milestone plan of the National Innovation System of Turkey project

SAMPLE

MILESTONE PLAN

PLANNED DATE	INFORMATI-ON COLLECT.	INFORMATI-ON DISTRIBUTION AND SHARING	PARTICIPA-TION	PROJECT DESCRIPTION: MANAGING THE NATIONAL INNOVATION SYTEM OF TURKEY	APPROVED BY/DATE PROJECT MANAGER
01 JUN 98	BT1			Literature survey	
####		BDP1	K1	Starting public information campaign	
####	BT2	BDP2	K2	Organizing the National Innovation Symposium	
####		BDP3	K3	Defining the National Innovation System	
####			K4	Forming the National Innovation Commission in the TGNA	
####			K5	Forming the NI sub-commissions in the administrative provinces base	
####			K6	Action plan and follow-up	

No date has been specified for this step. It should be determined as the result of the project management at the national level.

6.3 Responsibility Chart

GDPM method of organizing projects requires a thorough discussion of what the people involved in the project will do. Responsibility chart is named as *project responsibility chart* on the *global level* and *activity responsibility chart* on the *detail level.* Project responsibility charts explain and describe the roles of the different parties in important project matters. It can be regarded as a contract between the project and the parties involved. The activity responsibility chart explains and describes the roles of specific people in concrete project activities (**Andersen, Grude** and **Haug,** 1995).

Responsibility charts is also used to clarify roles, at both *global* and *detail levels.* Roles are the same at both levels. The responsibility chart makes it possible to mark who should "*do the job*" or who is in charge of executing a specific task. Different roles and the abbreviations which is used on the responsibility chart is in the below figure.

X	Executes the work
D	Takes decisions solely or ultimately
d	Takes decisions jointly or partly
P	Manages work and controls progress
T	Provides tuition on the job
C	Must be consulted
I	Must be informed
A	Available to advise

Figure 6.1 Roles in a project identified on the responsibility charts with their abbreviations (**Andersen, Grude** and **Haug,** 1995).

Table 6.2 Project responsibility chart

SAMPLE

PROJECT RESPONSIBILITY CHART

X :executes the work
D :takes decisions solely
d :takes decisions cointly
P :manages progress
T :provides tuition on the job
C :must be consulted
I :must be informed
A :available to advise

WORK DAYS	START DATE	PERIOD LENGTH MONTHS 3	6	9	12	15	18	21	24	COMPL. DATE	NO	MILESTONES	The president of TGNA	Prime Minister	Supreme Council for Science and Technology	TGNA National Innovation Commission	Turkish General Staff	The Sci.and Tech.Research Council of Turkey	Turkish Standarts Institutions	State Institute of Statistics	State Planning Organization	S and M Ind.Dev.Org./Nat.Productivity-Center	Tech. Development Foundation of Turkey	The Turkish Ind.s and Businessmen's Asso.	The Un.of C.s of Co.,In.,MT.and C.Ex.s of T.	Non-Governmental Organizations	Representatives of Universities	Representatives of Govern. Line Dept.s	The Media	Local Industrialists and Businessmen's Asso.	Representatives of Labor Unions	Repr.of Inter.Firms working in Turkey	Project Manager	Project members
90	01 JUN 98	→								01 SEP 98	1	Literature survey																					D	X
	01 SEP 98		→	→						####	2	Starting public information campaign	I	I	C		C	C	IC	IC	C	IA	IA	IA	IA	IA	I	I	I	I	I	I	XP D	XP d
	####			→	→					####	3	Organizing the National Innovation Symposium	I	DX	C X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Xd D	Xd
	####					→				####	4	Defining the National Innovation System			T		A	A	A	A	A	A	A	A	A	A	A	A		A	A	A	Xd D	Xd
	####					→				####	5	Forming the National Innovation Commission in the TGNA	D	D		X	A	A	A	A	A	A	A	A	A	A	A	A	I	A	A	A	P d	d
	####						→			####	6	Forming the NI sub-commissions in the administrative provinces base				DX	A	X	A	A	A	X	X	X	X	X	X	X	I X	X	X	X	A	A
	####						→	→	→	####	7	Action plan and follow-up				DX	A	X	A	A	A	X	X	X	X	X	X	X	I X	X	X	X	A	A

No date has been specified for this step. It should be determined as the result of the project management at the national level.

Table 6.3 Action plan for Literature survey

SAMPLE

ACTIVITY SCHEDULE **Action plan for Literature survey**

X :executes the work
D :takes decision solely
d :takes decision jointly
P :manages progress
T :provides tuition on the job
C :must be consulted
I :must be informed
A :available to advise

WORK DAYS	START DATE	PERIOD LENGTH MONTHS 1	2	3		COMPL. DATE	NO	ACTIVITIES	The president of TGNA	Prime Minister	Supreme Council for Science and Tech.	TGNA National Innovation Commission	Turkish General Staff	The Sci.and Tech.Research Council of Turkey	Turkish Standarts Institutions	State Institute of Statistics	State Planning Organization	S and M Ind.Dev.Org./Nat.Productivity Center	Tech.Development Foundation of Turkey	The Turkish Ind.s and Businessmen's Asso.	The Un.of C.s of Co.,In,MI, and C.Ex.s of T.	Non-Governmental Organizations	Representatives of Universities	Rep.s of Government Line Dept.s	The Media	Local Industrialists and Businessmen's Asso.	Representatives of Labor Unions	Repr.of Inter.Firms working in Turkey	Project Manager	Project members
60	01 JUN 98	→	→			01 AUG 98	1	Investigation of related web sites on internet																				D	X d
60	01 JUN 98	→	→			01 AUG 98	2	Requesting of needed information from related inst.s or org.s in Turkey																				D	X d
60	01 JUN 98	→	→			01 AUG 98	3	Searching needed information from libraries																				D	X d
30	01 AUG 98			→		01 SEP 98	4	Evaluation of informations																				D	X d

Table 6.4 Action plan for Starting public information campaign

SAMPLE

ACTIVITY SCHEDULE Action plan for Starting public information campaign

X :executes the work
D :takes decision solely
k :takes decision jointly
P :manages progress
T :provides tuition on the job
C :must be consulted
I :must be informed
A :available to advise

WORK DAYS	START DATE	PERIOD LENGTH MONTHS 3	6	9	12	COMPL.DATE	NO	ACTIVITIES	The president of TGNA	Prime Minister	Supreme Council for Science and Tech.	TGNA National Innovation Commission	Turkish General Staff	The Sci.and Tech.Research Council of Turkey	Turkish Standarts Institutions	State Institute of Statistics	State Planning Organization	S and M Ind.Dev.Org./Nat.Productivity Center	Tech.Development Foundation of Turkey	The Turkish Ind.s and Businessmen's Asso.	The Un.of C.s of Co.,In,MT,and C.Ex.s of T.	Non-Governmental Organizations	Representatives of Universities	Repr.s of Govern. Line Departments	The Media	Local Industrialists and Businessmen's Asso.	Representatives of Labor Unions	Repr.of Inter.Firms working in Turkey	Project Manager	Project members
45	01 SEP 98	→				15 OCT 98	1	Designing the project's web site on internet			I		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	D	Xd
23	15 OCT 98	→				07 NOV 98	2	Converting collected data into information using MORN																					D	X
112	07 NOV 98		→			1.мар.99	3	Evaluation of information by project team	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	D	X d
	####			→		####	4	Information meetings with media representatives	I	I														I	I	I			D	Xd
	####				→	####	5	Media campaign for general public																	X				D	Xd

No date has been specified for this step. It should be determined as the result of the project management at the national level.

Table 6.5 Action plan for Organizing the National Innovation Symposium

SAMPLE

ACTIVITY SCHEDULE Action plan for Organizing the National Innovation Symposium

X :executes the work
D :takes decision solely
d :takes decision jointly
P :manages progress
T :provides tuition on the job
C :must be consulted
I :must be informed
A :available to advice

WORK DAYS	START DATE	PERIOD LENGTH MOTHS 1.5	3	4.5	6	COMPL. DATE	NO	ACTIVITIES	The president of TGNA	Prime minister	Supreme Council for Science and Tech.	TGNA National Innovation Commission	Turkish General Staff	The Sci.and Tech.Research Council of Turkey	Turkish Standarts Institutions	State Institute of Statistics	State Planning Organization	S and M Ind.Dev.Org./Nat.Productivity Center	Tech.Development Foundation of Turkey	The Turkish Ind.s and Businessmen's Asso.	The Un.of C.s of Co.,In.MT, and C.Ex.s of T.	Non-Governmental Organizations	Representatives of Universities	Repr.s of Govern. Line Departments	The Media	Local Industrialists and Businessmen's Asso.	Representatives of Labor Unions	Repr.of Inter.Firms working in Turkey	Project manager	Project members
	####	→				####	1	Budgetary allocation for symposium	I	D	X d		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	X d	X d
	####	→	→			####	2	Determining persons and org.s/ins.s that are going to participate in the symp.	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C	I	C	C	I	D	X d
	####		→	→		####	3	Defining place and date of the symposium																	I				D	X d
	####			→	→	####	4	Announcing the symposium to general public	I	I	I		I	I	I	I	I	I	I	I	I	I	I	I	X	I	I	I	D	X d

No date has been specified for this step. It should be determined as the result of the project management at the national level.

Table 6.6 Action plan for Defining the National Innovation System

SAMPLE

ACTIVITY SCHEDULE Action plan for Defining the National Innovation System

X :executes the work
D :takes decision solely
d :takes decision jointly
P :manages progress
T :provides tuition on the job
C :must be consulted
I :must be informed
A :available to advise

WORK DAYS	START DATE	PERIOD LENGTH MONTHS 15days	COMPL. DATE	NO	ACTIVITIES	The president of TGNA	Prime Minister	Supreme Council for Science and Tech.	TGNA National Innovation Commission	Turkish General Staff	The Sci.and Tech.Research Council of Turkey	Turkish Standarts Institutions	State Institute of Statistics	State Planning Organization	S and M Ind.Dev.Org./Nat.Productivity Center	Tech.Development Foundation of Turkey	The Turkish Ind.s and Businessmen's Asso.	The Un.of C.s of Co.,In,MT,and C.Ex.s of T.	Non-Governmental Organizations	Representatives of Universities	Repr.s of Govern. Line Departments	The Media	Local Industrialists and Businessmen's Asso.	Representatives of Labor Unions	Repr.of Inter.Firms working in Turkey	Project Manager	Project members
	01 JUN 98	→	####	1	Investigating other countries' organizations and institutitons studies																					D	Xd
	####	→	####	2	Studying gathering information																					D	Xd
	####	→	####	3	Defining the National Innovation System of Turkey																					D	X d

No date has been specified for this step. It should be determined as the result of the project management at the national level.

Table 6.7 Action plan for Forming the National Innovation Commission in the TGNA

SAMPLE

ACTIVITY SCHEDULE Action plan for Forming the National Innovation Commission in the TGNA

X :executes the work
D :takes decision solely
d :takes decision jointly
P :manages progress
T :provides tuition on the job
C :must be consulted
I :must be informed
A :available to advise

WORK DAYS	START DATE	PERIOD LENGTH MONTHS 1	3	4.5	6	COMPL.DATE	NO	ACTIVITIES	The president of TGNA	Prime Minister	Supreme Council for Science and Tech.	TGNA National Innovation Commission	Turkish General Staff	The Sci.and Tech.Research Council of Turkey	Turkish Standart Institutions	State Institute of Statistics	State Planning Organization	S and M Ind.Dev.Org./Nat.Productivity Center	Tech.Development Foundation of Turkey	The Turkish Ind.s and Businessmen's Asso.	The Un.of C.so f Co.,In,MT,and C.Ex.s of T.	Non-Governmental Organizations	Representatives of Universities	Repr.s of Govern. Line Departments	The Media	Local Industrialists and Businessmen's Asso.	Representatives of Labor Unions	Repr.of Inter.Firms working in Turkey	Project Manager	Project members
	15 APR 99	→				####	1	Defining the characteristics of TGNA National Innovation Commission	D	C	C		C	C	C	C	C	C	C	C	C	C	C	C		C	C		X d	X d
	####		→	→		####	2	Proposing to be established of TGNA National Innovation Commission by means of making law	D	X d	I		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I		X d	X d

No date has been specified for this step. It should be determined as the result of the project management at the national level.

Table 6.8 Action plan for Forming the NI sub-commissions in the administrative provinces base

SAMPLE

ACTIVITY SECHEDULE Action plan for forming the NI sub-commissions in the administrative provinces base

X :executes the work
D :takes decision solely
d :takes decision jointly
P :manages progress
T :provides tuition on the job
C :must be consulted
I :must be informed
A :available to advise

WORK DAYS	START DATE	PERIOD LENGTH MONTHS 1.5	3	4.5	6	COMPL.DATE	NO	ACTIVITIES	The president of TGNA	Prime Minister	Supreme Council for Science and Tech.	TGNA National Innovation Commission	Turkish General Staff	The Sci.and Tech.Research Council of Turkey	Turkish Standarts Institutions	State Institute of Statistics	State Planning Organization	S and M Ind.Dev.Org./Nat.Productivity Center	Tech.Development Foundation of Turkey	The Turkish Ind.s and Businessmen's Asso.	The Un.of C.s of Co.,In,MI,and C.Ex.s of T.	Non-Governmental Organizations	Representatives of Universities	Repr.s of Govern. Line Departments	The Media	Local Industrialists and Businessmen's Asso.	Representatives of Labor Unions	Repr.of Inter.Firms working in Turkey	Project Manager	Project members
	25 APR 99	→				####	1	Defining the charc.s of the NI sub-comm.s in the admin.provinces base		C	C	D Xd	C	C	C	C	C	C	C	C	C	C	C	C		C	C		X d	X d
	####		→			####	2	Defining the structure and activity fields of the NI Sub-commissions		C	C	DX d	C	C	C	C	C	C	C	C	C	C	C	C		C	C		X d	X d
	####			→		####	3	Forming the NI sub-commissions			I	D X	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	X d	X d
	####				→	####	4	Beginning to function of NI sub-commissions	X d	X d	X d	X D	X d	X d	X d	X d	X d	X d	X d	X d	X d	X d	X d	X d		X d	X d	X d	X d	X d

No date has been specified for this step. It should be determined as the result of the project management at the national level.

Table 6.9 Action plan for Action plan and follow-up

SAMPLE

ACTIVITY SCHEDULE Action plan for Action plan and follow-up

X :executes the work
D :takes decision solely
d :takes decision jointly
P :manages progress
T :provides tuition on the job
C :must be consulted
I :must be informed
A :available to advise

WORK DAYS	START DATE	PERIOD LENGTH MONTHS 1.5	3	4.5	6	COMPL.DATE	NO	ACTIVITIES	The president of TGNA	Prime Minister	Supreme Council for Science and Tech.	TGNA National Innovation Commission	Turkish General Staff	The Sci.and Tech.Research Council of Turkey	Turkish Standarts Institutions	State Institute of Statistics	State Planning Organization	S and M Ind.Dev.Org./Nat.Productivity Center	Tech.Development Foundation of Turkey	The Turkish Ind.s and Businessmen's Asso.	The Un.of C.s of Co.,In,MT,and C.Ex.s of T.	Non-Governmental Organizations	Representatives of Universities	Repr.s of Govern. Line Departments	The Media	Local Industrialists and Businessmen's Asso.	Representatives of Labor Unions	Repr.of Inter.Firms working in Turkey	Project Manager	Project members
	01 JUN 99	→				####	1	To Develop an Innovation Culture		C	C	D Xd	C	C	C	C	C	C	C	C	C	C	C	C		C	C	C	X d	X d
	####		→			####	2	To Establish a Legal,Regulatory and Financ. Framework Conducive to Inno.		C	C	DX d	C	X d	C	C -	C	C	C	C	C	C	C	C	I	C	C	C	X d	X d
	####			→		####	3	To adjust research more closely to inno. at both nati.and community level			I	D X	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	X d	X d

No date has been specified for this step. It should be determined as the result of the project management at the national level.

6.4 Assessment of the Project *"National Innovation Project – Technological Change and Monitoring Innovation Processes in Turkish Manufacturing Industry"*

The *P-S-O concept* reminds us of the importance of balancing all three elements; ***people***, ***system*** and ***organization***. This project is focused only on manufacturing industry and does not meet the P-S-O concept. This project should be defined within the larger scale of the "***National Innovation System***".

When we examined this project in point of ***participation***, it can easily be seen that the actors or stakeholders of the project remain within the narrow scale. Maximization of participation is very important for these kinds of projects. The basic organization should be the Turkish people. All related organizations/institutions should be included in this project.

When we examined this project in point of ***sharing ownership***, it can easily be seen that the actors or stakeholders of the project remain within the narrow scale. Sharing ownership should be spread all over the country. All the information related with this project should be shared among all government organizations, non-governmental organizations, universities, firms etc.

When we examined this project in point of ***project management***, it can easily be seen that there is not a specific methodology used for managing this project. This project should be managed in "***P-S-O way of thinking***". *GDPM* is a good project management tool for this purpose, and also, a methodology such as *MORN* should be used as *communication infrastructure* for this project.

"*National Innovation Project work schedule*" is enclosed as Appendix 3.

7. CONCLUSION

All countries have a ***National Innovation System.*** The differences remain in their distribution power of knowledge. Our definition for the ***National Innovation System*** of Turkey is "***A set of interacting institutions, organizations, firms and policies in order to get, share and diffuse technology and knowledge equally all over the country for economically stronger, socially more happy and satisfied, culturally more active and more dynamic Turkey***".

Innovation processes are influenced by many factors; they occur in interaction between institutional and organizational elements which together may be called "***Systems of Innovation***". The ***National Innovation System*** approach has recently received considerable attention and is considered by many to be a useful and promising analytical tool for better understanding innovation processes as well as the production and distribution of knowledge in the economy and industry. This approach, like all new approaches, is associated with conceptual and theoretical problems and weaknesses.

There are unavoidable systemic weaknesses that inhibit the development of technological and innovative capabilities in enterprises, organizations/institutions in Turkey. Turkey's government policies must be re-oriented to correct systemic weaknesses of the ***National Innovation System*** of Turkey. To act for innovation is in first instance the responsibility of citizens, of industry and of national, regional and local authorities.

This study is a more system-oriented evaluation approach of the ***National Innovation System*** of Turkey. The objective of this study is not to provide a complete theoretical analysis. It is to form a framework of the applicability of the concept of the ***National Innovation System*** and to explore and initiate a discussion on the future of science and technology policy in Turkey. This study is an opportunity to have a critical glance at the characteristics of ***National Innovation System*** for Turkey.

The simulation phase of system dynamics of ***National Innovation System*** is not included in this study. This could be the subject of a further study.

The ***National Innovation System*** of Turkey can only be managed using a methodological framework. I defined only sample *activity plans* using *GDPM methodology*.

In this perspective, an action plan should be defined by the government for ***National Innovation System***. Three general areas for action is being suggested:

To develop an innovation culture;

a. Priority should be given to education and training,

b. Easier mobility should be provided for researchers and engineers among regions,

c. Effective approaches to innovation in the economy and in society should be demonstrated,

d. The best management and organizational methods amongst businesses should be propagated,

e. Innovation in the public sector and in government should be stimulated.

To establish a legal, regulatory and financial framework conducive to innovation;

a. A legal and regulatory environment should be adapted and simplified,

b. Innovation financing in Turkey should be made easier.

To adjust research more closely to innovation at both national and community level;

a. A strategic foresight vision of research and of its application should be developed,

b. The research carried out by the industry, in both absolute and relative terms should be strengthened,

c. The start-up of technology-based firms should be strongly encouraged,

d. The cooperation between public, university and industrial research should be intensified,

e. The capacity of SMEs for absorbing new technologies and know-how, whatever their origin, should be strengthened.

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APPENDIX 1

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APPENDIX 2

Bilgi Tabanı

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	New Technologies and Employment: Highlights of an	RAP	85	AÖ	361
	Managing Invention and Innovation	MAK	85	EMR	388
	Descriptions of the Elements in the NIS	WEB	90	WEB	379
	Innovation Across Culturel Borders	WEB	80	AÖ	370
	Action Line: Innovation Management Techniques, Some	WEB	85	WEB	369
	International Transfer of Organisational Innovation	RAP	95	AÖ	368
	The Phenomenon of Innovation Overload	MAK	85	EMR	367
	How to Keep That Innovative Spirit Alive	MAK	85	EMR	366
	Diffusing Technology to Industry: Government Policies and	WEB	90	WEB	380
	Systems Archetypes	KIT	100	BA	372
	Institutional Mapping of Finland's National System of	WEB	95	WEB	383
	Acquisitions as Sources of Technological Innovation	MAK	95	EMR	373
	ACTION PLAN FOR LITERATURE SURVEY	BRM	100	proje	420
	Innovation Management Techniques, Synopsis of Projects,	RAP	85	AÖ	360
	Five Year Assessment of the Specific Programme: Targeted	RAP	85	AÖ	359
	Science and Technology Main Indicators and Basic	RAP	90	AÖ	384
	Report from the Commission to the European Parliament	RAP	85	AÖ	358
	Get Innovative or Get Dead (Part One)	MAK	85	EMR	385
	Get Innovative or Get Dead (Part Two)	MAK	85	EMR	386
	Five Year Assessment of the Specific Programme: Marine	RAP	85	AÖ	357
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	356
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
	Technology Institutions and Policies	RAP	85	AÖ	395
	UYSY PROJESİ YÖNETİCİ ÖZETİ	BRM	95	proje	408
	UYSY PROJESİ METİN KISMI	BRM	95	proje	407
	UYSY PROJESİ METİN KISMI	BRM	95	proje	407
	UYSY PROJESİ SORUMLULUK TABLOSU	BRM	95	GDPM	405
	UYSY ORGANİZASYON ŞEMASI	KYN	95	tez	402
	UYSY ORGANİZASYON ŞEMASI	KYN	95	tez	402
	UYSY ORGANİZASYON ŞEMASI	KYN	95	tez	402
	UYSY İLGİLİ TARAFLAR	KYN	95	tez	401
	Conference on Policy Evaluation in Innovation and	WEB	90	WEB	378
	Dreams to Market: Crafting a Culture of Innovation	MAK	85	EMR	396
	System Dynamics, System Thinking and Soft OR	WEB	85	BA	362
	Technology Institutions and Policies	RAP	85	AÖ	395
	Sustainability and Technology-A Framework for Discussion	RAP	85	AÖ	394
	TEZ BİRİNCİ BÖLÜM	KYN	100	tez	426
	Turkey&The World 2010-2020 Emergence of a Global Actor	KIT	85	AÖ	392
	Building Technology Diffusion Networks and Systems	WEB	100	WEB	377
	Building Successful Multi-Partner Projects, the Moderated	WEB	80	WEB	376

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	Building Successful Multi-Partner Projects, the Moderated	WEB	80	WEB	376
	Building Successful Multi-Partner Projects, the Moderated	WEB	80	WEB	376
	TEZ ÖN KISIM	KYN	100	tez	448
	UYSY İLGİLİ TARAFLAR	KYN	95	tez	401
	Institutional Mapping of MIS: Guidelines for Country	KIT	85	AÖ	341
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	355
	White paper on Science&Technology, Preparing for The	RAP	100	WEB	351
	Sistemik Şablonlar genel Formatı	BRM	70	AÖ	338
	Systems of Innovation Approaches-Their Emergence and	RAP	100	WEB	352
	Tipyapı yorumları	KYN	70	AÖ	340
	Toplantı duyurusu	KYN	70	AÖ	339
	Innovating Through Alliances: Expectations and	MAK	85	EMR	347
	At the Front End of the R&D/Innovation Process	MAK	85	EMR	389
	Industrial Efficiency, a Literature Synthesis Prepared for	RAP	90	AÖ	353
	TEZ İKİNCİ BÖLÜM	KYN	100	tez	441
	Introduction to the System Dynamics	KIT	95	BA	350
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	354
	Gagging on Chaos	MAK	85	EMR	345
	Technology Transfer, Information Flows and Collaboration:	RAP	100	AÖ	348
	ULUSAL YENİLİK SEMPOZYUMUNUN ORGANİZASYONU A.G.	BRM	95	proje	412
	MILESTONE PLAN	BRM	100	proje	418
	System Thinking Basics	KIT	90	BA	344
4 ncü bölüm					
	UYSY PROJESİ STAKEHOLDERS	BRM	100	proje	417
6 ncı bölüm					
	ULUSAL YENİLİK SİSTEMİNİN TANIMLANMASI A.G.	BRM	95	proje	413
	Goal Directed Project Management	KIT	100	AÖ	343
	ACTION PLAN FOR STARTING PUBLIC INFORMATION	BRM	100	proje	421
	ACTION PLAN FOR ACTION PLAN AND FOLLOW-UP	BRM	100	proje	442
	ACTION PLAN FOR LITERATURE SURVEY	BRM	100	proje	420
	ACTION PLAN FOR ORGANIZING THE NATIONAL	BRM	100	proje	422
	ACTION PLAN FOR FORMING THE NI SUB-COMMISSIONS	BRM	100	proje	425
	ACTION PLAN FOR DEFINING THE NATIONAL INNOVATION	BRM	100	proje	423
	MILESTONE PLAN	BRM	100	proje	418
	UYSY PROJESİ ORGANIZATION CHART	BRM	100	proje	416
	RESPONSIBILITY CHART	BRM	100	proje	419
	ACTION PLAN FOR FORMING THE NATIONAL INNOVATION	BRM	100	proje	424
Almanya					
	Institutional Mapping of MIS: Guidelines for Country	KIT	85	AÖ	341
alt komisyon					
	İLLERDE ULUSAL YENİLİK ALT KOMİSYONUNUN	BRM	95	proje	415
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
	ACTION PLAN FOR FORMING THE NI SUB-COMMISSIONS	BRM	100	proje	425

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
amaç					
	UYSY PROJESİ METİN KISMI	BRM	95	proje	407
AÖ					
	Toplantı duyurusu	KYN	70	AÖ	339
	Teknoloji ve Kırsal Gelişim: Güneydoğu Anadolu	RAP	85	AÖ	391
	Institutional Mapping of MIS: Guidelines for Country	KIT	85	AÖ	341
	Tipyapı yorumları	KYN	70	AÖ	340
arge					
	White paper on Science&Technology, Preparing for The	RAP	100	WEB	351
	Araştırma-Geliştirme (AR-GE) Yardımı Uygulama Esasları	KYN	80	NB	390
	At the Front End of the R&D/Innovation Process	MAK	85	EMR	389
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
aşama göstergesi					
	ACTION PLAN FOR ORGANIZING THE NATIONAL	BRM	100	proje	422
	ULUSAL YENİLİK SEMPOZYUMUNUN ORGANİZASYONU A.G.	BRM	95	proje	412
	UYSY PROJESİ METİN KISMI	BRM	95	proje	407
	ULUSAL YENİLİK SİSTEMİNİN TANIMLANMASI A.G.	BRM	95	proje	413
	ACTION PLAN FOR FORMING THE NI SUB-COMMISSIONS	BRM	100	proje	425
	ACTION PLAN FOR LITERATURE SURVEY	BRM	100	proje	420
	MILESTONE PLAN	BRM	100	proje	418
	RESPONSIBILITY CHART	BRM	100	proje	419
	TEZ ALTINCI BÖLÜM	KYN	100	tez	430
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
	BİLGİLENDİRME KAMPANYASININ BAŞLATILMASI A.G.	BRM	95	proje	410
	ACTION PLAN FOR DEFINING THE NATIONAL INNOVATION	BRM	100	proje	423
	ACTION PLAN FOR ACTION PLAN AND FOLLOW-UP	BRM	100	proje	442
	DOKÜMANTASYON ÇALIŞMASI A.G. FAALİYET PLANI	BRM	95	proje	411
	ACTION PLAN FOR STARTING PUBLIC INFORMATION	BRM	100	proje	421
	UYSY PROJESİ SORUMLULUK TABLOSU	BRM	95	GDPM	405
avantaj					
	Technology and Strategic Advantage	MAK	85	EMR	387
BA					
	Introduction to the System Dynamics	KIT	95	BA	350
	System Dynamics, System Thinking and Soft OR	WEB	85	BA	362
	K.H.O.Sistem Dinamikleri sitesi	WEB	90	K.H.O.	335
	System Dynamics and K-12 Teachers	WEB	85	BA	364
	Systems Archetypes	KIT	100	BA	372
	System Thinking Basics	KIT	90	BA	344
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
bağımlılık					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
balıkçılık					
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	354

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
başarı					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
başarısız					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
beklenmeyen					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
bildiri					
	YA/EM'99 KONGRESİ BİLDİRİ ÖZETİ	MAK	85	AÖ	440
bilgi					
	DOKÜMANTASYON ÇALIŞMASI A.G. FAALİYET PLANI	BRM	95	proje	411
	ACTION PLAN FOR STARTING PUBLIC INFORMATION	BRM	100	proje	421
bilgi akışı					
	Technology Transfer, Information Flows and Collaboration:	RAP	100	AÖ	348
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
bilgi toplama					
	ACTION PLAN FOR LITERATURE SURVEY	BRM	100	proje	420
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
bilgi yönetimi					
	MORN (Multimedia Object Relation Network)	MAK	96	NB	436
bilgilendirme					
	BİLGİLENDİRME KAMPANYASININ BAŞLATILMASI A.G.	BRM	95	proje	410
bilgilendirme kampan					
	ACTION PLAN FOR STARTING PUBLIC INFORMATION	BRM	100	proje	421
bilim					
	Science and Technology Main Indicators and Basic	RAP	90	AÖ	384
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
	White paper on Science&Technology, Preparing for The	RAP	100	WEB	351
	National Systems of Innovation: Implications on Science	WEB	100	WEB	375
bilişim					
	Technology Transfer, Information Flows and Collaboration:	RAP	100	AÖ	348
	Institutional Mapping of MIS: Guidelines for Country	KIT	85	AÖ	341
Boğaziçi Ün.					
	Personal and electronic communications with Prof. Dr.	GOR	100	AÖ	435
bölgesel					
	National Innovation Systems	WEB	100	WEB	382
	TEZ ÜÇÜNCÜ BÖLÜM	KYN	100	tez	427
bölüm					
	TEZ İKİNCİ BÖLÜM	KYN	100	tez	441
	TEZ ÜÇÜNCÜ BÖLÜM	KYN	100	tez	427
	TEZ BİRİNCİ BÖLÜM	KYN	100	tez	426
	TEZ ALTINCI BÖLÜM	KYN	100	tez	430
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	TEZ YEDİNCİ BÖLÜM	KYN	100	tez	431
büyüme					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
çözüm					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
danışman					
	Atilla Öner	SAH	100	e-mail	337
davranış					
	Counterintuitive Behaviour of Social systems	WEB	85	BA	363
denizcilik					
	Five Year Assessment of the Specific Programme: Marine	RAP	85	AÖ	357
dışişleri bakanlığı					
	Turkey&The World 2010-2020 Emergence of a Global Actor	KIT	85	AÖ	392
dökümantasyon					
	DOKÜMANTASYON ÇALIŞMASI A.G. FAALİYET PLANI	BRM	95	proje	411
döngü					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
DPT					
	Electronic communications with Mr. Ahmet Ege	GOR	80	AÖ	432
düşmanlık					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
ek					
	APPENDIX 1	KYN	100	tez	453
	APPENDIX 2	KYN	100	tez	452
	MORN (Multimedia Object Relation Network)	MAK	96	NB	436
ekonomi					
	Innovation Diffusion and Political Control of Energy	KYN	96	AÖ	439
	Personnel Communications with Weber K. M.	GOR	96	AÖ	438
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
elektronik					
	Electronic communications with Mr. Aykut Göker	GOR	100	AÖ	433
	Electronic communications with Mr. Ahmet Ege	GOR	80	AÖ	432
	Personal and electronic communications with Prof. Dr.	GOR	100	AÖ	435
endüstri					
	Industrial Efficiency, a Literature Synthesis Prepared for	RAP	90	AÖ	353
	YA/EM'99 KONGRESİ BİLDİRİ ÖZETİ	MAK	85	AÖ	440
	Diffusing Technology to Industry: Government Policies and	WEB	90	WEB	380
European Commission					
	Five Year Assessment of the Specific Programme: Targeted	RAP	85	AÖ	359
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
	Report from the Commission to the European Parliament	RAP	85	AÖ	358
	Innovation Management Techniques, Synopsis of Projects,	RAP	85	AÖ	360
	Industrial Efficiency, a Literature Synthesis Prepared for	RAP	90	AÖ	353

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	Five Year Assessment of the Specific Programme: Marine	RAP	85	AÖ	357
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	356
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	355
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	354
	New Technologies and Employment: Highlights of an	RAP	85	AÖ	361
faaliyet planı					
	DOKÜMANTASYON ÇALIŞMASI A.G. FAALİYET PLANI	BRM	95	proje	411
	ULUSAL YENİLİK SEMPOZYUMUNUN ORGANİZASYONU A.G.	BRM	95	proje	412
	BİLGİLENDİRME KAMPANYASININ BAŞLATILMASI A.G.	BRM	95	proje	410
	The First Action Plan for Innovation in Europe	WEB	85	WEB	371
	TBMM'DE ULUSAL YENİLİK KOMİSYONUNUN	BRM	95	proje	414
	ULUSAL YENİLİK SİSTEMİNİN TANIMLANMASI A.G.	BRM	95	proje	413
	ACTION PLAN FOR ACTION PLAN AND FOLLOW-UP	BRM	100	proje	442
	ACTION PLAN FOR STARTING PUBLIC INFORMATION	BRM	100	proje	421
	ACTION PLAN FOR FORMING THE NATIONAL INNOVATION	BRM	100	proje	424
	ACTION PLAN FOR DEFINING THE NATIONAL INNOVATION	BRM	100	proje	423
	ACTION PLAN FOR ORGANIZING THE NATIONAL	BRM	100	proje	422
	TEZ ALTINCI BÖLÜM	KYN	100	tez	430
	ACTION PLAN FOR LITERATURE SURVEY	BRM	100	proje	420
	ACTION PLAN FOR FORMING THE NI SUB-COMMISSIONS	BRM	100	proje	425
Finlandiya					
	Institutional Mapping of Finland's National System of	WEB	95	WEB	383
firma					
	Enhanching the Management of Innovation in Firms	WEB	90	WEB	381
GAP					
	Teknoloji ve Kırsal Gelişim: Güneydoğu Anadolu	RAP	85	AÖ	391
GDPM					
	DOKÜMANTASYON ÇALIŞMASI A.G. FAALİYET PLANI	BRM	95	proje	411
	BİLGİLENDİRME KAMPANYASININ BAŞLATILMASI A.G.	BRM	95	proje	410
	MILESTONE PLAN	BRM	100	proje	418
	RESPONSIBILITY CHART	BRM	100	proje	419
	ACTION PLAN FOR LITERATURE SURVEY	BRM	100	proje	420
	TEZ ALTINCI BÖLÜM	KYN	100	tez	430
	ACTION PLAN FOR ORGANIZING THE NATIONAL	BRM	100	proje	422
	Goal Directed Project Management	KIT	100	AÖ	343
	TEZ İKİNCİ BÖLÜM	KYN	100	tez	441
	ACTION PLAN FOR ACTION PLAN AND FOLLOW-UP	BRM	100	proje	442
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
	UYSY PROJESİ METİN KISMI	BRM	95	proje	407
	UYSY PROJESİ SORUMLULUK TABLOSU	BRM	95	GDPM	405
	ACTION PLAN FOR STARTING PUBLIC INFORMATION	BRM	100	proje	421
	ULUSAL YENİLİK SİSTEMİNİN TANIMLANMASI A.G.	BRM	95	proje	413
	İLLERDE ULUSAL YENİLİK ALT KOMİSYONUNUN	BRM	95	proje	415

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	ULUSAL YENİLİK SEMPOZYUMUNUN ORGANİZASYONU A.G.	BRM	95		proje 412
	TBMM'DE ULUSAL YENİLİK KOMİSYONUNUN	BRM	95	proje	414
gelişme					
	From Experience Technical Development and the	MAK	90	EMR	374
gerekçeler					
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
	UYSY İLGİLİ TARAFLAR	KYN	95	tez	401
	UYSY PROJESİ STAKEHOLDERS	BRM	100	proje	417
	Descriptions of the Elements in the NIS	WEB	90	WEB	379
giriş					
	TEZ BİRİNCİ BÖLÜM	KYN	100	tez	426
görüşme					
	Electronic communications with Mr. Aykut Göker	GOR	100	AÖ	433
	Personal communications with Mr. Kemal Saydamer	GOR	100	AÖ	434
	Electronic communications with Mr. Ahmet Ege	GOR	80	AÖ	432
	Personnel Communications with Weber K. M.	GOR	96	AÖ	438
	Personal and electronic communications with Prof. Dr.	GOR	100	AÖ	435
	Innovation Diffusion and Political Control of Energy	KYN	96	AÖ	439
Güney Afrika					
	White paper on Science&Technology, Preparing for The	RAP	100	WEB	351
hedef					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
İspanya					
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
İsveç					
	Systems of Innovation Approaches-Their Emergence and	RAP	100	WEB	352
İşsizlik					
	New Technologies and Employment: Highlights of an	RAP	85	AÖ	361
icat					
	Managing Invention and Innovation	MAK	85	EMR	388
içindekiler					
	TEZ ÖN KISIM	KYN	100	tez	448
il					
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
	İLLERDE ULUSAL YENİLİK ALT KOMİSYONUNUN	BRM	95	proje	415
ilgili taraflar					
	ULUSAL YENİLİK SEMPOZYUMUNUN ORGANİZASYONU A.G.	BRM	95		proje 412
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
	Descriptions of the Elements in the NIS	WEB	90	WEB	379
	RESPONSIBILITY CHART	BRM	100	proje	419
	TBMM'DE ULUSAL YENİLİK KOMİSYONUNUN	BRM	95	proje	414
	UYSY ORGANİZASYON ŞEMASI	KYN	95	tez	402
	TEZ ALTINCI BÖLÜM	KYN	100	tez	430

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	ACTION PLAN FOR ORGANIZING THE NATIONAL	BRM	100	proje	422
	ACTION PLAN FOR LITERATURE SURVEY	BRM	100	proje	420
	ULUSAL YENİLİK SİSTEMİNİN TANIMLANMASI A.G.	BRM	95	proje	413
	ACTION PLAN FOR FORMING THE NI SUB-COMMISSIONS	BRM	100	proje	425
	DOKÜMANTASYON ÇALIŞMASI A.G. FAALİYET PLANI	BRM	95	proje	411
	UYSY İLGİLİ TARAFLAR	KYN	95	tez	401
	UYSY PROJESİ ORGANIZATION CHART	BRM	100	proje	416
	BİLGİLENDİRME KAMPANYASININ BAŞLATILMASI A.G.	BRM	95	proje	410
	UYSY PROJESİ METİN KISMI	BRM	95	proje	407
	ACTION PLAN FOR ACTION PLAN AND FOLLOW-UP	BRM	100	proje	442
	ACTION PLAN FOR STARTING PUBLIC INFORMATION	BRM	100	proje	421
	UYSY PROJESİ SORUMLULUK TABLOSU	BRM	95	GDPM	405
	İLLERDE ULUSAL YENİLİK ALT KOMİSYONUNUN	BRM	95	proje	415
	ACTION PLAN FOR DEFINING THE NATIONAL INNOVATION	BRM	100	proje	423
	UYSY PROJESİ STAKEHOLDERS	BRM	100	proje	417
istatistik					
	Science and Technology Main Indicators and Basic	RAP	90	AÖ	384
işbirliği					
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	355
Japonya					
	Japanese Technological Innovation Strategy: Recent	MAK	85	EMR	349
kampanya					
	BİLGİLENDİRME KAMPANYASININ BAŞLATILMASI A.G.	BRM	95	proje	410
kaos					
	Gagging on Chaos	MAK	85	EMR	345
kapak					
	TEZ KAPAK	KYN	100	tez	451
katılım					
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
kavram					
	TEZ ÜÇÜNCÜ BÖLÜM	KYN	100	tez	427
kaynak					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
	APPENDIX 1	KYN	100	tez	453
	REFERANSLAR	KYN	100	tez	450
KHO					
	K.H.O.Sistem Dinamikleri sitesi	WEB	90	K.H.O.	335
kısaltmalar					
	LIST OF ABBREVIATIONS	KYN	100	tez	444
kişisel					
	Personal and electronic communications with Prof. Dr.	GOR	100	AÖ	435
	Personnel Communications with Weber K. M.	GOR	96	AÖ	438
	Personal communications with Mr. Kemal Saydamer	GOR	100	AÖ	434

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KOBİ					
	Report from the Commission to the European Parliament	RAP	85	AÖ	358
komisyon					
	TBMM'DE ULUSAL YENİLİK KOMİSYONUNUN	BRM	95	proje	414
	İLLERDE ULUSAL YENİLİK ALT KOMİSYONUNUN	BRM	95	proje	415
	ACTION PLAN FOR FORMING THE NATIONAL INNOVATION 424	BRM	100	proje	
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
	ACTION PLAN FOR FORMING THE NI SUB-COMMISSIONS	BRM	100	proje	425
kongre					
	YA/EM'99 KONGRESİ BİLDİRİ ÖZETİ	MAK	85	AÖ	440
kuruluş şeması					
	UYSY PROJESİ ORGANIZATION CHART	BRM	100	proje	416
kurum					
	Technology Institutions and Policies	RAP	85	AÖ	395
kurumsal					
	Counterintuitive Behaviour of Social systems	WEB	85	BA	363
	International Transfer of Organisational Innovation	RAP	95	AÖ	368
külfet					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
kültür					
	Dreams to Market: Crafting a Culture of Innovation	MAK	85	EMR	396
	Innovation Across Culturel Borders	WEB	80	AÖ	370
medya					
	Toplantı duyurusu	KYN	70	AÖ	339
metodoloji					
	TEZ İKİNCİ BÖLÜM	KYN	100	tez	441
	Teknoloji ve Kırsal Gelişim: Güneydoğu Anadolu	RAP	85	AÖ	391
	MORN (Multimedia Object Relation Network)	MAK	96	NB	436
	TEZ ALTINCI BÖLÜM	KYN	100	tez	430
	Innovation Diffusion and Political Control: The Politics,	RAP	100	AÖ	393
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
Mısır					
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
MORN					
	APPENDIX 2	KYN	100	tez	452
	MORN (Multimedia Object Relation Network)	MAK	96	NB	436
	TEZ İKİNCİ BÖLÜM	KYN	100	tez	441
NB					
	Araştırma-Geliştirme (AR-GE) Yardımı Uygulama Esasları	KYN	80	NB	390
	MORN (Multimedia Object Relation Network)	MAK	96	NB	436
OECD					
	Institutional Mapping of MIS: Guidelines for Country	KIT	85	AÖ	341
ön kısım					

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	TEZ ÖN KISIM	KYN	100	tez	448
onay					
	TEZ ONAY SAYFASI	KYN	100	tez	447
organizasyon					
	ULUSAL YENİLİK SEMPOZYUMUNUN ORGANİZASYONU A.G.	BRM	95		proje 412
	UYSY ORGANİZASYON ŞEMASI	KYN	95	tez	402
ormancılık					
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	354
ortak					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
özet					
	TEZ ÖN KISIM	KYN	100	tez	448
özgeçmiş					
	ÖZGEÇMİŞ	KYN	100	tez	449
paylaşım					
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
performans					
	Action Line: Innovation Management Techniques, Some	WEB	85	WEB	369
PET					
	Personnel Communications with Weber K. M.	GOR	96	AÖ	438
	TEZ İKİNCİ BÖLÜM	KYN	100	tez	441
	Innovation Diffusion and Political Control: The Politics,	RAP	100	AÖ	393
	Teknoloji ve Kırsal Gelişim: Güneydoğu Anadolu	RAP	85	AÖ	391
	Innovation Diffusion and Political Control of Energy	KYN	96	AÖ	439
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
politika					
	Technology Institutions and Policies	RAP	85	AÖ	395
	Personnel Communications with Weber K. M.	GOR	96	AÖ	438
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
	Conference on Policy Evaluation in Innovation and	WEB	90	WEB	378
	Diffusing Technology to Industry: Government Policies and	WEB	90	WEB	380
	Innovation Diffusion and Political Control of Energy	KYN	96	AÖ	439
	National Systems of Innovation: Implications on Science	WEB	100	WEB	375
proje					
	UYSY PROJESİ METİN KISMI	BRM	95	proje	407
	TBMM'DE ULUSAL YENİLİK KOMİSYONUNUN	BRM	95	proje	414
	ACTION PLAN FOR ORGANIZING THE NATIONAL	BRM	100	proje	422
	UYSY PROJESİ SORUMLULUK TABLOSU	BRM	95	GDPM	405
	BİLGİLENDİRME KAMPANYASININ BAŞLATILMASI A.G.	BRM	95	proje	410
	MILESTONE PLAN	BRM	100	proje	418
	ACTION PLAN FOR FORMING THE NATIONAL INNOVATION	BRM	100		proje 424
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
	ACTION PLAN FOR DEFINING THE NATIONAL INNOVATION	BRM	100		proje 423

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	RESPONSIBILITY CHART	BRM	100	proje	419
	UYSY PROJESİ YÖNETİCİ ÖZETİ	BRM	95	proje	408
	ULUSAL YENİLİK SİSTEMİNİN TANIMLANMASI A.G.	BRM	95	proje	413
	A Guide to the Project Management Body of Knowledge	KIT	80	AÖ	454
	ACTION PLAN FOR FORMING THE NI SUB-COMMISSIONS	BRM	100	proje	425
	UYSY PROJESİ STAKEHOLDERS	BRM	100	proje	417
	Goal Directed Project Management	KIT	100	AÖ	343
	Innovation Management Techniques, Synopsis of Projects,	RAP	85	AÖ	360
	UYSY PROJESİ ORGANIZATION CHART	BRM	100	proje	416
	DOKÜMANTASYON ÇALIŞMASI A.G. FAALİYET PLANI	BRM	95	proje	411
	UYSY İLGİLİ TARAFLAR	KYN	95	tez	401
	Building Successful Multi-Partner Projects, the Moderated	WEB	80	WEB	376
	TEZ WEB SAYFASI	WEB	100	AÖ	443
	ULUSAL YENİLİK SEMPOZYUMUNUN ORGANİZASYONU A.G.	BRM	95	proje	412
	UYSY ORGANİZASYON ŞEMASI	KYN	95	tez	402
	İLLERDE ULUSAL YENİLİK ALT KOMİSYONUNUN	BRM	95	proje	415
proje yönetimi					
	Goal Directed Project Management	KIT	100	AÖ	343
referans					
	Report from the Commission to the European Parliament	RAP	85	AÖ	358
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
	Five Year Assessment of the Specific Programme: Marine	RAP	85	AÖ	357
	System Dynamics, System Thinking and Soft OR	WEB	85	BA	362
	Counterintuitive Behaviour of Social systems	WEB	85	BA	363
	Dreams to Market: Crafting a Culture of Innovation	MAK	85	EMR	396
	Japanese Technological Innovation Strategy: Recent	MAK	85	EMR	349
	Five Year Assessment of the Specific Programme: Targeted	RAP	85	AÖ	359
	Technology Institutions and Policies	RAP	85	AÖ	395
	International Transfer of Organisational Innovation	RAP	95	AÖ	368
	Electronic communications with Mr. Aykut Göker	GOR	100	AÖ	433
	System Dynamics and K-12 Teachers	WEB	85	BA	364
	Systems Archetypes	KIT	100	BA	372
	Building Technology Diffusion Networks and Systems	WEB	100	WEB	377
	Building Successful Multi-Partner Projects, the Moderated	WEB	80	WEB	376
	Teknoloji ve Kırsal Gelişim: Güneydoğu Anadolu	RAP	85	AÖ	391
	Systems of Innovation Approaches-Their Emergence and	RAP	100	WEB	352
	White paper on Science&Technology, Preparing for The	RAP	100	WEB	351
	Acquisitions as Sources of Technological Innovation	MAK	95	EMR	373
	New Technologies and Employment: Highlights of an	RAP	85	AÖ	361
	National Systems of Innovation: Implications on Science	WEB	100	WEB	375
	Turkey&The World 2010-2020 Emergence of a Global Actor	KIT	85	AÖ	392
	From Experience Technical Development and the	MAK	90	EMR	374
	Industrial Efficiency, a Literature Synthesis Prepared for	RAP	90	AÖ	353

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	How to Keep That Innovative Spirit Alive	MAK	85	EMR	366
	Innovation Diffusion and Political Control: The Politics,	RAP	100	AÖ	393
	Personal communications with Mr. Kemal Saydamer	GOR	100	AÖ	434
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	354
	The First Action Plan for Innovation in Europe	WEB	85	WEB	371
	Innovation Management Techniques, Synopsis of Projects,	RAP	85	AÖ	360
	Personal and electronic communications with Prof. Dr.	GOR	100	AÖ	435
	Innovation Across Culturel Borders	WEB	80	AÖ	370
	Action Line: Innovation Management Techniques, Some	WEB	85	WEB	369
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	355
	Araştırma-Geliştirme (AR-GE) Yardımı Uygulama Esasları	KYN	80	NB	390
	The Phenomenon of Innovation Overload	MAK	85	EMR	367
	Sustainability and Technology-A Framework for Discussion	RAP	85	AÖ	394
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	356
	Introduction to the System Dynamics	KIT	95	BA	350
	Managing Invention and Innovation	MAK	85	EMR	388
	Get Innovative or Get Dead (Part One)	MAK	85	EMR	385
	Gagging on Chaos	MAK	85	EMR	345
	Science and Technology Main Indicators and Basic	RAP	90	AÖ	384
	Electronic communications with Mr. Ahmet Ege	GOR	80	AÖ	432
	Get Innovative or Get Dead (Part Two)	MAK	85	EMR	386
	National Innovation Systems	WEB	100	WEB	382
	Innovation Diffusion and Political Control of Energy	KYN	96	AÖ	439
	Diffusing Technology to Industry: Government Policies and	WEB	90	WEB	380
	Technology and Strategic Advantage	MAK	85	EMR	387
	At the Front End of the R&D/Innovation Process	MAK	85	EMR	389
	Conference on Policy Evaluation in Innovation and	WEB	90	WEB	378
	System Thinking Basics	KIT	90	BA	344
	A Guide to the Project Management Body of Knowledge	KIT	80	AÖ	454
	Strategic Technology Management	KIT	85	AÖ	336
	Institutional Mapping of MIS: Guidelines for Country	KIT	85	AÖ	341
	Descriptions of the Elements in the NIS	WEB	90	WEB	379
	Innovating Through Alliances: Expectations and	MAK	85	EMR	347
	Personnel Communications with Weber K. M.	GOR	96	AÖ	438
	Enhanching the Management of Innovation in Firms	WEB	90	WEB	381
	Institutional Mapping of Finland's National System of	WEB	95	WEB	383
	Technology Transfer, Information Flows and Collaboration:	RAP	100	AÖ	348
	Goal Directed Project Management	KIT	100	AÖ	343
referanslar					
	REFERANSLAR	KYN	100	tez	450
Rusya					
	Science and Technology Main Indicators and Basic	RAP	90	AÖ	384
sanat					

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	Toplantı duyurusu	KYN	70	AÖ	339
sektör					
	TEZ ÜÇÜNCÜ BÖLÜM	KYN	100	tez	427
	National Innovation Systems	WEB	100	WEB	382
sempozyum					
	ACTION PLAN FOR ORGANIZING THE NATIONAL	BRM	100	proje	422
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
	ULUSAL YENİLİK SEMPOZYUMUNUN ORGANİZASYONU A.G.	BRM	95	proje	412
sistem					
	Building Technology Diffusion Networks and Systems	WEB	100	WEB	377
	Systems of Innovation Approaches-Their Emergence and	RAP	100	WEB	352
	National Systems of Innovation: Implications on Science	WEB	100	WEB	375
	TEZ ÜÇÜNCÜ BÖLÜM	KYN	100	tez	427
	YA/EM'99 KONGRESİ BİLDİRİ ÖZETİ	MAK	85	AÖ	440
	TBMM'DE ULUSAL YENİLİK KOMİSYONUNUN	BRM	95	proje	414
	System Thinking Basics	KIT	90	BA	344
	ULUSAL YENİLİK SİSTEMİNİN TANIMLANMASI A.G.	BRM	95	proje	413
	K.H.O.Sistem Dinamikleri sitesi	WEB	90	K.H.O.	335
	Counterintuitive Behaviour of Social systems	WEB	85	BA	363
	National Innovation Systems	WEB	100	WEB	382
sistem dinamikleri					
	Introduction to the System Dynamics	KIT	95	BA	350
	System Dynamics, System Thinking and Soft OR	WEB	85	BA	362
	System Thinking Basics	KIT	90	BA	344
	System Dynamics and K-12 Teachers	WEB	85	BA	364
	Systems Archetypes	KIT	100	BA	372
	K.H.O.Sistem Dinamikleri sitesi	WEB	90	K.H.O.	335
	Personal and electronic communications with Prof. Dr.	GOR	100	AÖ	435
sistemik şablonlar					
	Tipyapı yorumları	KYN	70	AÖ	340
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
	Systems Archetypes	KIT	100	BA	372
	K.H.O.Sistem Dinamikleri sitesi	WEB	90	K.H.O.	335
	Personal and electronic communications with Prof. Dr.	GOR	100	AÖ	435
	Sistemik Şablonlar genel Formatı	BRM	70	AÖ	338
	System Thinking Basics	KIT	90	BA	344
	Introduction to the System Dynamics	KIT	95	BA	350
sonuç					
	TEZ YEDİNCİ BÖLÜM	KYN	100	tez	431
sorumluluk çizelgesi					
	RESPONSIBILITY CHART	BRM	100	proje	419
sosyal					
	Counterintuitive Behaviour of Social systems	WEB	85	BA	363

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
sosyo-ekonomi					
	Five Year Assessment of the Specific Programme: Targeted	RAP	85	AÖ	359
system thinking					
	System Dynamics, System Thinking and Soft OR	WEB	85	BA	362
şekiller					
	LIST OF FIGURES	KYN	100	tez	445
tablolar					
	LIST OF TABLES	KYN	100	tez	446
tarım					
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	354
TBMM					
	Personal communications with Mr. Kemal Saydamer	GOR	100	AÖ	434
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
	ACTION PLAN FOR FORMING THE NI SUB-COMMISSIONS	BRM	100	proje	425
	İLLERDE ULUSAL YENİLİK ALT KOMİSYONUNUN	BRM	95	proje	415
	ACTION PLAN FOR FORMING THE NATIONAL INNOVATION	BRM	100	proje	424
	TBMM'DE ULUSAL YENİLİK KOMİSYONUNUN	BRM	95	proje	414
tedarik					
	DOKÜMANTASYON ÇALIŞMASI A.G. FAALİYET PLANI	BRM	95	proje	411
teknik					
	Action Line: Innovation Management Techniques, Some	WEB	85	WEB	369
teknoloji					
	National Systems of Innovation: Implications on Science	WEB	100	WEB	375
	Sustainability and Technology-A Framework for Discussion	RAP	85	AÖ	394
	TEZ WEB SAYFASI	WEB	100	AÖ	443
	Teknoloji ve Kırsal Gelişim: Güneydoğu Anadolu	RAP	85	AÖ	391
	Science and Technology Main Indicators and Basic	RAP	90	AÖ	384
	YA/EM'99 KONGRESİ BİLDİRİ ÖZETİ	MAK	85	AÖ	440
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
	Innovation Diffusion and Political Control: The Politics,	RAP	100	AÖ	393
	Technology and Strategic Advantage	MAK	85	EMR	387
	Personnel Communications with Weber K. M.	GOR	96	AÖ	438
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
	Atilla Öner	SAH	100	e-mail	337
	Five Year Assessment of the Specific Programme: Marine	RAP	85	AÖ	357
	Strategic Technology Management	KIT	85	AÖ	336
	Japanese Technological Innovation Strategy: Recent	MAK	85	EMR	349
	Technology Institutions and Policies	RAP	85	AÖ	395
	Building Technology Diffusion Networks and Systems	WEB	100	WEB	377
	Innovation Diffusion and Political Control of Energy	KYN	96	AÖ	439
	From Experience Technical Development and the	MAK	90	EMR	374
	Conference on Policy Evaluation in Innovation and	WEB	90	WEB	378
	White paper on Science&Technology, Preparing for The	RAP	100	WEB	351

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	National Innovation Systems	WEB	100	WEB	382
teknoloji transferi					
	Technology Transfer, Information Flows and Collaboration:	RAP	100	AÖ	348
teknoloji yayılımı					
	Diffusing Technology to Industry: Government Policies and	WEB	90	WEB	380
teknoloji yayımı					
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
teknoloji yönetimi					
	Enhanching the Management of Innovation in Firms	WEB	90	WEB	381
	Strategic Technology Management	KIT	85	AÖ	336
teknolojik yenilik					
	Acquisitions as Sources of Technological Innovation	MAK	95	EMR	373
tez					
	TEZ İKİNCİ BÖLÜM	KYN	100	tez	441
	MORN (Multimedia Object Relation Network)	MAK	96	NB	436
	REFERANSLAR	KYN	100	tez	450
	LIST OF FIGURES	KYN	100	tez	445
	APPENDIX 1	KYN	100	tez	453
	TEZ YEDİNCİ BÖLÜM	KYN	100	tez	431
	Atilla Öner	SAH	100	e-mail	337
	ÖZGEÇMİŞ	KYN	100	tez	449
	APPENDIX 2	KYN	100	tez	452
	LIST OF TABLES	KYN	100	tez	446
	LIST OF ABBREVIATIONS	KYN	100	tez	444
	K.H.O.Sistem Dinamikleri sitesi	WEB	90	K.H.O.	335
	TEZ ONAY SAYFASI	KYN	100	tez	447
	TEZ KAPAK	KYN	100	tez	451
	ACTION PLAN FOR FORMING THE NATIONAL INNOVATION	BRM	100	proje	424
	TEZ ÖN KISIM	KYN	100	tez	448
	TEZ ALTINCI BÖLÜM	KYN	100	tez	430
toplantı					
	Toplantı duyurusu	KYN	70	AÖ	339
	Atilla Öner	SAH	100	e-mail	337
trajedi					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
Tunus					
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
TÜBİTAK					
	Araştırma-Geliştirme (AR-GE) Yardımı Uygulama Esasları	KYN	80	NB	390
	Electronic communications with Mr. Aykut Göker	GOR	100	AÖ	433
Türkiye					
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
ulusal					

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	TEZ ÜÇÜNCÜ BÖLÜM	KYN	100	tez	427
	National Systems of Innovation: Implications on Science	WEB	100	WEB	375
	National Innovation Systems	WEB	100	WEB	382
uluslar üstü					
	TEZ ÜÇÜNCÜ BÖLÜM	KYN	100	tez	427
uluslararası					
	National Innovation Systems	WEB	100	WEB	382
UYSY					
	Report from the Commission to the European Parliament	RAP	85	AÖ	358
	TEZ YEDİNCİ BÖLÜM	KYN	100	tez	431
	Technology Transfer, Information Flows and Collaboration:	RAP	100	AÖ	348
	Systems of Innovation Approaches-Their Emergence and	RAP	100	WEB	352
	System Thinking Basics	KIT	90	BA	344
	Innovating Through Alliances: Expectations and	MAK	85	EMR	347
	Sistemik Şablonlar genel Formatı	BRM	70	AÖ	338
	Tipyapı yorumları	KYN	70	AÖ	340
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	355
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	354
	TEZ İKİNCİ BÖLÜM	KYN	100	tez	441
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	356
	Goal Directed Project Management	KIT	100	AÖ	343
	Electronic communications with Mr. Aykut Göker	GOR	100	AÖ	433
	Strategic Technology Management	KIT	85	AÖ	336
	Industrial Efficiency, a Literature Synthesis Prepared for	RAP	90	AÖ	353
	White paper on Science&Technology, Preparing for The	RAP	100	WEB	351
	Introduction to the System Dynamics	KIT	95	BA	350
	Five Year Assessment of the Specific Programme: Marine	RAP	85	AÖ	357
	Atilla Öner	SAH	100	e-mail	337
	Japanese Technological Innovation Strategy: Recent	MAK	85	EMR	349
	Gagging on Chaos	MAK	85	EMR	345
	UYSY İLGİLİ TARAFLAR	KYN	95	tez	401
	A Guide to the Project Management Body of Knowledge	KIT	80	AÖ	454
	TEZ WEB SAYFASI	WEB	100	AÖ	443
	ACTION PLAN FOR ORGANIZING THE NATIONAL	BRM	100	proje	422
	ACTION PLAN FOR DEFINING THE NATIONAL INNOVATION	BRM	100	proje	423
	UYSY PROJESİ AŞAMA GÖSTERGELERİ	BRM	95	proje	409
	UYSY PROJESİ YÖNETİCİ ÖZETİ	BRM	95	proje	408
	ACTION PLAN FOR FORMING THE NATIONAL INNOVATION	BRM	100	proje	424
	UYSY PROJESİ METİN KISMI	BRM	95	proje	407
	UYSY PROJESİ SORUMLULUK TABLOSU	BRM	95	GDPM	405
	ACTION PLAN FOR ACTION PLAN AND FOLLOW-UP	BRM	100	proje	442
	Five Year Assessment of the Specific Programme: Targeted	RAP	85	AÖ	359
	ACTION PLAN FOR STARTING PUBLIC INFORMATION	BRM	100	proje	421

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	Dreams to Market: Crafting a Culture of Innovation	MAK	85	EMR	396
	Technology Institutions and Policies	RAP	85	AÖ	395
	Sustainability and Technology-A Framework for Discussion	RAP	85	AÖ	394
	TEZ BİRİNCİ BÖLÜM	KYN	100	tez	426
	Innovation Diffusion and Political Control: The Politics,	RAP	100	AÖ	393
	Turkey&The World 2010-2020 Emergence of a Global Actor	KIT	85	AÖ	392
	Teknoloji ve Kırsal Gelişim: Güneydoğu Anadolu	RAP	85	AÖ	391
	TEZ ÜÇÜNCÜ BÖLÜM	KYN	100	tez	427
	Building Technology Diffusion Networks and Systems	WEB	100	WEB	377
	ACTION PLAN FOR FORMING THE NI SUB-COMMISSIONS	BRM	100	proje	425
	Technology and Strategic Advantage	MAK	85	EMR	387
	İLLERDE ULUSAL YENİLİK ALT KOMİSYONUNUN	BRM	95	proje	415
	TBMM'DE ULUSAL YENİLİK KOMİSYONUNUN	BRM	95	proje	414
	ULUSAL YENİLİK SİSTEMİNİN TANIMLANMASI A.G.	BRM	95	proje	413
	ULUSAL YENİLİK SEMPOZYUMUNUN ORGANİZASYONU A.G.	BRM	95	proje	412
	UYSY PROJESİ ORGANIZATION CHART	BRM	100	proje	416
	DOKÜMANTASYON ÇALIŞMASI A.G. FAALİYET PLANI	BRM	95	proje	411
	UYSY PROJESİ STAKEHOLDERS	BRM	100	proje	417
	BİLGİLENDİRME KAMPANYASININ BAŞLATILMASI A.G.	BRM	95	proje	410
	MILESTONE PLAN	BRM	100	proje	418
	Conference on Policy Evaluation in Innovation and	WEB	90	WEB	378
	Managing Invention and Innovation	MAK	85	EMR	388
	Descriptions of the Elements in the NIS	WEB	90	WEB	379
	RESPONSIBILITY CHART	BRM	100	proje	419
	Get Innovative or Get Dead (Part Two)	MAK	85	EMR	386
	Get Innovative or Get Dead (Part One)	MAK	85	EMR	385
	Science and Technology Main Indicators and Basic	RAP	90	AÖ	384
	ACTION PLAN FOR LITERATURE SURVEY	BRM	100	proje	420
	Institutional Mapping of Finland's National System of	WEB	95	WEB	383
	National Innovation Systems	WEB	100	WEB	382
	Enhanching the Management of Innovation in Firms	WEB	90	WEB	381
	Diffusing Technology to Industry: Government Policies and	WEB	90	WEB	380
	UYSY ORGANİZASYON ŞEMASI	KYN	95	tez	402
	At the Front End of the R&D/Innovation Process	MAK	85	EMR	389
	TEZ DÖRDÜNCÜ BÖLÜM	KYN	100	tez	429
	Innovation Across Culturel Borders	WEB	80	AÖ	370
	Action Line: Innovation Management Techniques, Some	WEB	85	WEB	369
	International Transfer of Organisational Innovation	RAP	95	AÖ	368
	The Phenomenon of Innovation Overload	MAK	85	EMR	367
	Systems Archetypes	KIT	100	BA	372
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
	Acquisitions as Sources of Technological Innovation	MAK	95	EMR	373
	From Experience Technical Development and the	MAK	90	EMR	374

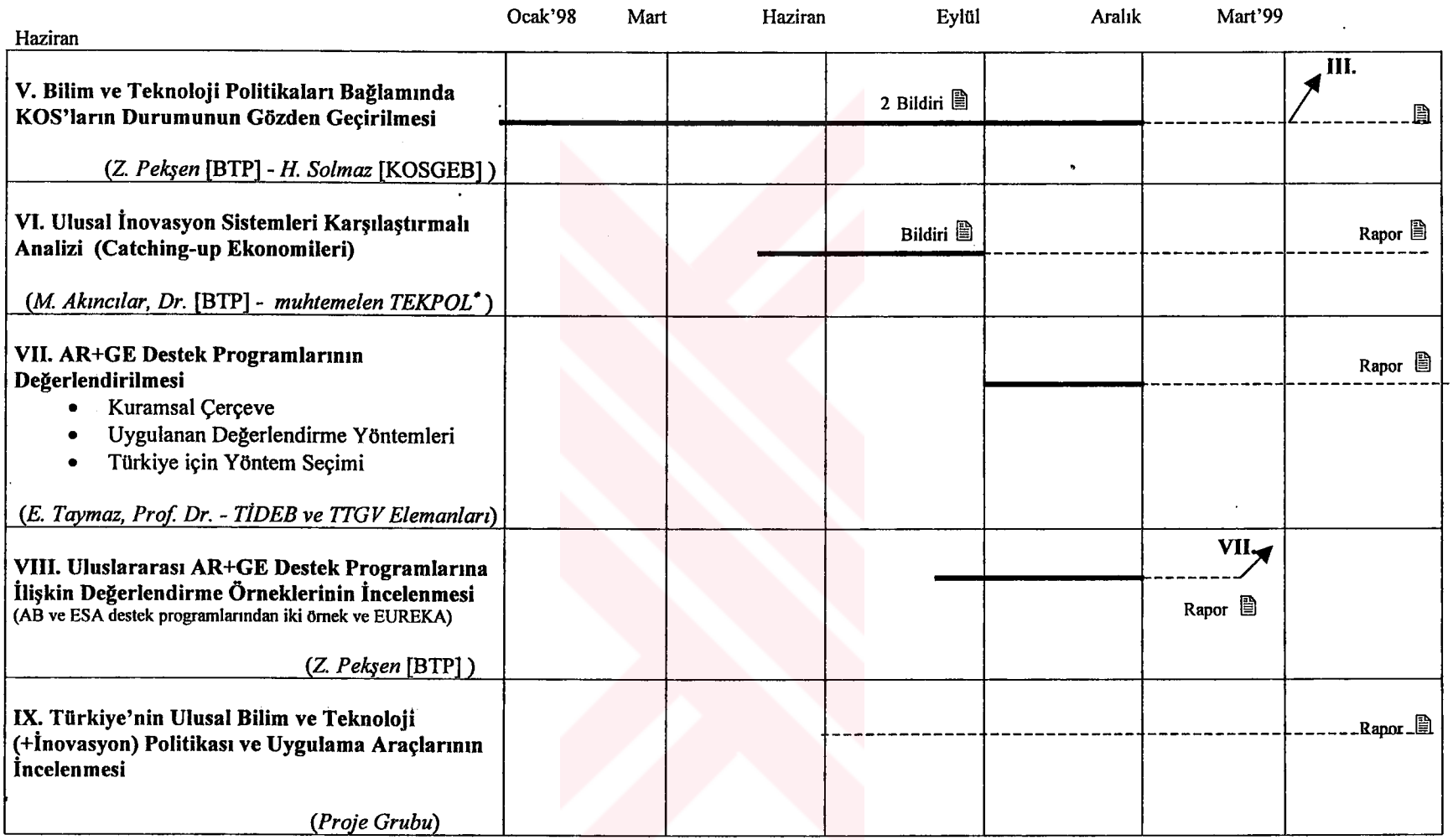
Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	The First Action Plan for Innovation in Europe	WEB	85	WEB	371
	How to Keep That Innovative Spirit Alive	MAK	85	EMR	366
	National Systems of Innovation: Implications on Science	WEB	100	WEB	375
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
	System Dynamics and K-12 Teachers	WEB	85	BA	364
	Counterintuitive Behaviour of Social systems	WEB	85	BA	363
	System Dynamics, System Thinking and Soft OR	WEB	85	BA	362
	TEZ ALTINCI BÖLÜM	KYN	100	tez	430
	New Technologies and Employment: Highlights of an	RAP	85	AÖ	361
	Innovation Management Techniques, Synopsis of Projects,	RAP	85	AÖ	360
ülke					
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	355
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
	Science and Technology Main Indicators and Basic	RAP	90	AÖ	384
	National Innovation Systems	WEB	100	WEB	382
	Institutional Mapping of MIS: Guidelines for Country	KIT	85	AÖ	341
	Institutional Mapping of Finland's National System of	WEB	95	WEB	383
	National Systems of Innovation: Implications on Science	WEB	100	WEB	375
	Japanese Technological Innovation Strategy: Recent	MAK	85	EMR	349
	Turkey&The World 2010-2020 Emergence of a Global Actor	KIT	85	AÖ	392
Ürdün					
	Science&Technology Policy in Southern Mediterranean	RAP	85	AÖ	365
web					
	Sistemik Şablonlar genel Formatı	BRM	70	AÖ	338
	TEZ WEB SAYFASI	WEB	100	AÖ	443
	Tipyapı yorumları	KYN	70	AÖ	340
World Bank					
	Technology Institutions and Policies	RAP	85	AÖ	395
yasa					
	İLLERDE ULUSAL YENİLİK ALT KOMİSYONUNUN	BRM	95	proje	415
	TBMM'DE ULUSAL YENİLİK KOMİSYONUNUN	BRM	95	proje	414
yatırım					
	TEZ BEŞİNCİ BÖLÜM	KYN	100	tez	428
yayılım					
	Innovation Diffusion and Political Control: The Politics,	RAP	100	AÖ	393
	Building Technology Diffusion Networks and Systems	WEB	100	WEB	377
yeditepe					
	Atilla Öner	SAH	100	e-mail	337
yenilik					
	Five Year Assessment of the Specific Programme:	RAP	85	AÖ	356
	Technology and Strategic Advantage	MAK	85	EMR	387
	Get Innovative or Get Dead (Part Two)	MAK	85	EMR	386
	Get Innovative or Get Dead (Part One)	MAK	85	EMR	385

Anahtar	Açıklama	Tip	Ağr	Kaynak	No
	Toplantı duyurusu	KYN	70	AÖ	339
	Counterintuitive Behaviour of Social systems	WEB	85	BA	363
	Managing Invention and Innovation	MAK	85	EMR	388
	Innovation Diffusion and Political Control: The Politics,	RAP	100	AÖ	393
	National Systems of Innovation: Implications on Science	WEB	100	WEB	375
	At the Front End of the R&D/Innovation Process	MAK	85	EMR	389
	New Technologies and Employment: Highlights of an	RAP	85	AÖ	361
	White paper on Science&Technology, Preparing for The	RAP	100	WEB	351
	Strategic Technology Management	KIT	85	AÖ	336
	TEZ ÜÇÜNCÜ BÖLÜM	KYN	100	tez	427
	Innovation Management Techniques, Synopsis of Projects,	RAP	85	AÖ	360
	Report from the Commission to the European Parliament	RAP	85	AÖ	358
	Atilla Öner	SAH	100	e-mail	337
	Diffusing Technology to Industry: Government Policies and	WEB	90	WEB	380
	Gagging on Chaos	MAK	85	EMR	345
	Innovation Across Culturel Borders	WEB	80	AÖ	370
	The First Action Plan for Innovation in Europe	WEB	85	WEB	371
	TEZ WEB SAYFASI	WEB	100	AÖ	443
	Action Line: Innovation Management Techniques, Some	WEB	85	WEB	369
	Innovating Through Alliances: Expectations and	MAK	85	EMR	347
	International Transfer of Organisational Innovation	RAP	95	AÖ	368
	Conference on Policy Evaluation in Innovation and	WEB	90	WEB	378
	The Phenomenon of Innovation Overload	MAK	85	EMR	367
	How to Keep That Innovative Spirit Alive	MAK	85	EMR	366
	Enhanching the Management of Innovation in Firms	WEB	90	WEB	381
	Institutional Mapping of MIS: Guidelines for Country	KIT	85	AÖ	341
	Dreams to Market: Crafting a Culture of Innovation	MAK	85	EMR	396
	ACTION PLAN FOR FORMING THE NATIONAL INNOVATION		BRM	100	proje
424					
	Tipyapı yorumları	KYN	70	AÖ	340
	Industrial Efficiency, a Literature Synthesis Prepared for	RAP	90	AÖ	353
	YA/EM'99 KONGRESİ BİLDİRİ ÖZETİ	MAK	85	AÖ	440
	Systems of Innovation Approaches-Their Emergence and	RAP	100	WEB	352
	From Experience Technical Development and the	MAK	90	EMR	374
yenilik sistemi					
	TEZ ÜÇÜNCÜ BÖLÜM	KYN	100	tez	427
	Innovation Management Techniques, Synopsis of Projects,	RAP	85	AÖ	360
	Systems of Innovation Approaches-Their Emergence and	RAP	100	WEB	352
	Descriptions of the Elements in the NIS	WEB	90	WEB	379
	National Innovation Systems	WEB	100	WEB	382
	Institutional Mapping of Finland's National System of	WEB	95	WEB	383
yönetim					
	Building Successful Multi-Partner Projects, the Moderated	WEB	80	WEB	376
	The First Action Plan for Innovation in Europe	WEB	85	WEB	371

Anahtar yöneylem	Açıklama	Tip	Ağr	Kaynak	No
	System Dynamics, System Thinking and Soft OR	**WEB**	85	BA	362
	YA/EM'99 KONGRESİ BİLDİRİ ÖZETİ	**MAK**	85	AÖ	440

ULUSAL İNOVASYON PROJESİ İŞ PLANI, Ocak 99 itibariyle durum.

	Ocak'98	Mart	Haziran	Eylül	Aralık	Mart'99	Haziran
I. Okuma ve Öğrenme *(Proje Grubu)*							
II. Dokümantasyon • Literatür Taraması • Derleme-Kategorizasyon *(A.Duman-E.Özberk [BTP])*					Doküm.>950		Doküm.
III. İmalat Sanayi İnovasyon Anketi (4266 işyeri) Sonuç Değerlendirme Raporu: • Ölçek~İnovasyon eğilim ve kapasiteleri • Sektör~İnovasyon eğilim ve kapasiteleri • Nerede inovasyon: ürün/süreç/organizasyon • İnovasyonu engelleyici faktörler • "Catching-up" ekonomilerinde ölçüm/izleme/yöntem sorunları Ek Analizler: • Patent/faydalı model/marka tescili analizi • AR+GE göstergeleri ~ İnovasyon anket sonuçları analizi • Sektör ve ölçekler bazında teknolojik değişim hızı analizleri *(DİE - Proje Grubu)*		HAZIRLIK	ÇALIŞMASI	Bildiri ANKET		Anket Sonuç.	Değer. Rap.
IV. Türk Sanayiinin Yapısal Özellikleri ve Sanayi Kültürü Etüdü *(İ. Otağ/Z. Pekşen [BTP])*							III.



* **TEKPOL:** Teknoloji Politikaları Araştırma Merkezi, ODTÜ

CV

Birth of date	17.09.1961	
Birth of place	İzmir	
High School	1975-1976	Denizli High School Denizli
	1976-1978	Kuleli Military High School İstanbul
Bachelor's Degree	1978-1982	Military Academy (Management) Ankara
Courses	FA Officer Advanced Course Ft.Sill OK./USA 1992 Systems Engineering Certificate Program, Military Academy 1997 Ankara	
Institution	Army	