THE ANALYSIS OF A POLICY DOCUMENT: "TURKISH SCIENCE POLICY FROM 1983 TO 2003"

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Abstract: This study aims to analyze the text entitled "Turkish Science Policy from 1983 to 2003" using the conceptual framework of public policy. Having been prepared over a period of more than two years with contributions by some 300 scientists and experts from universities, TUBITAK and other public institutions of research who come from a diversity of disciplines, this text embraces a system approach in determining a science and research policy for Turkey. For this reason, the set of concepts in the discipline of public policy will be used to analyze it. This will allow us to reveal what reasons lied behind such a text in the circumstances of the day, how successfully the text identified the issues in the system of science and technology, and how well-placed the proposed long-term solutions to these issues were. The study has been designed in four main parts. While the first part will address the conceptual framework regarding public policy, the second part will review the pre-1980 science agenda of the state. The third part will deal with the methodology and content of the document "Turkish Science Policy from 1983 to 2003" from the perspective of public policy, and finally the fourth part will investigate the reasons for its failure through comparison with similar documents that were produced later.
Keywords: Science and technology, public policy, science policy.

Introduction

The emergence of science policy comes with the Second World War when scientific research turns its focus toward strategic goals and military projects (Türkcan, 2003). The wave of research and development investments that begins with the Manhattan Project, the clearest example of strong government intervention in science policy, continues throughout the Cold War (Conner, 2003: 461). The increased importance of science leads to its use not only in the military but also in other public policy domains (Erat & Arap, 2016a). In this regard, science policy starts to spread in developed and developing nations in the '60s owing to a new understanding of the power of science, a search for rationality in all public policy domains, and initiatives by international actors like the OECD.

Science policy first appears in Turkey around the same time. It emerges in the era of planned development that opens in the '60s since, first, planning is a research-driven product and requires research institutions, and second, science itself makes part of the policy agenda (Erat & Arap, 2016b). From 1960 to 1980, however, no comprehensive science policy emerges, and even the goals in the much-emphasized issues of research staff and research areas cannot be achieved. For this reason, the country lags behind other countries working on science policy during the same period.

Turkish Science Policy from 1983 to 2003 was produced following a detailed study to meet the desired level of progress. The document bears significance in three aspects. First, while some development plans and other earlier documents involves elements that can be interpreted as science policy, this has been the first study to carry out serious analyses, propose long-term solutions to issues, and formulate policy in clear terms. Second, it was prepared using a systems approach. Third, no such study had hitherto been encountered in the formulation of other public policies, either. *Turkish Science Policy from 1983 to 2003* is not only a reference document for all scientific work in this area but also an object of study by itself. Elmacı's work focuses on particular policies in the document rather than its methodology (Elmacı, 2015).

The present study will analyze *Turkish Science Policy from 1983 to 2003* using the conceptual framework of public policy. Thus, it will cover the systems approach as used in the document and the methods it resorts to in policy formulation. The study has been designed in four parts. While the first part will address the systems approach, the second part will review the pre-1980 state science policy. The third part will deal with the methodology and content of *Turkish Science Policy from 1983 to 2003* from the perspective of public policy, and the last part will put the document in a comparison with similar later documents.

Policy As a System

A system is a set of interdependent or interrelated parts that make up an organized or complex collective whole. The systems approach in political science works to account for the entire political process, including the functions of fundamental political actors, through a systems analysis (Heywood, 2012: 45). The systems approach rests on the 1937 work *General Systems Theory* by the biologist Ludwig Von Bertalanffy (Altan, 2016: 306). According to Bertalanffy, the origin of the concept *system* dates back to the pre-Socratic era, and the Aristotelian statement that *the whole is more than the sum of its parts* is an important expression of the ongoing problematic of system. While advancements in Western science did away with the Aristotelian worldview, he argues, the problems concerning the organization of living systems were largely ignored rather than solved. Bertalanffy tries to justify his theory by referring to some particular advancements in science. Modern science is characterized by a tremendous availability of data, technical complexity, and an increase in specialization in every area required by theoretical structures. As a result, physicists, biologists, psychologists, and social scientists have each reverted to their own universe, and it is hard to transition from one area to another. Strikingly, however, similar problems and concepts exist in different areas that evolve independently of each other. Parallel developments occur in different areas within mutual independence and often without knowledge of what is going on elsewhere. For instance, there is a similarity in procedure between a biological theory, which works with concepts such as individuals, species, and competition coefficients, and quantitive economics or econometrics. On the other hand, the impact of new advancements in biological, behavioral, and social sciences requires us to expand our conceptual schema where physics applications fall short. For instance, while living organisms exchanging matter with their environment are open systems, conventional physics and physical chemistry deal with closed systems only.

Bertalanffy argues that such new developments point to the need for generalized systems and make it legitimate to work on a theory of universal principles. He proposes the General Systems Theory as a discipline, which deals with the formulation of principles that hold true for systems. According to him, this indicates the major aims of general systems theory: (1) There is a general tendency towards integration in the various sciences, natural and social. (2) Such integration seems to be centered in a general theory of systems. (3) Such theory may be an important means for aiming at exact theory in the nonphysical fields of science. (4) Developing unifying principles running "vertically" through the universe of the individual sciences, this theory brings us nearer to the goal of the unity of science. (5) This can lead to a much-needed integration in scientific education.

Bertalanffy uses his theory in biology and psychology and suggests that it can be used in all scientific fields. David Easton is the first to adapt the theory to political science and thus to contribute to the development of basic concepts in contemporary policy analysis (Jr, Hedge & Lester, 2008: 95; Knoepfel, Larrue, Frédéric & Hill, 2007: 7). While it is not originally intended for public policy, Easton's work is used in conceptualizing the relationship between policymaking, policy outputs, and the environment, and it influences public policy work produced in the '60s (Parsons, 2001: 23-24). According to Easton, political inquiry concerns itself with how decision-making takes place in society and how decisions are implemented, and considering political life as a system of activities must be key in any approach to analyze the working of this system. Taking the system of political activity as a whole, Easton states that different inputs (demands and supports) exist that sustain the working of the system, that these inputs are transformed into outputs (decisions or policies) by the system processes, and that these outputs bear consequences for the system and the environment both (Easton, 1957: 383-384).

Public policy is viewed as the reaction of the system to demands from the environment. The political system as defined by Easton involves interrelated institutions and processes that generate binding decisions on society and are generally considered to be governmental institutions and political processes. The environment, on the other hand, involves all phenomena such as the social system, the economic system, and the biological environment that lie outside the boundaries of the political system. Thus, the political system differs from all other components of society. The demands that enter the political system as inputs from the environment are actions by individuals and groups to fulfill their interests and values. The "supports" part of the inputs consists of the agreement of individuals and groups to respect election results, pay tax, abide by law, and accept decisions and actions the political system offers as responses to demands. Legislations, rules, court decisions etc., on the other hand, make up the system's outputs (Anderson, 1994: 27). These outputs generate feedback, which, in turn, shapes later demands and supports (Heywood, 2013: 41). The main condition for the system to succeed is to process inputs in the political system and to generate outputs that can meet demands and draw majority support. Therefore, the assessment of how outputs impact the environment and the political system is highly crucial for the system (Saybaşılı, 1985: 25-26).

The systems approach is seen to be helpful in organizing policymaking research and also illuminating in other important aspects of the political process. How do demands from the environment affect the content of public policy and the functioning of the political system? How does public policy affect the environment or consequent policy demands? How good is the political system at converting demands into public policy and preserving itself over time? (Anderson, 1994: 27) Nonewithstanding, the most important critique brought up to Easton's systems approach is that it takes the system as a black box, leaving the internal functioning of the political system unexplained (Birkland, 2011: 27; Birkland, 2005: 188). Since it fails to talk about decision-making procedures and processes in length and treats policy as the product of a black box called the political system, the use of his approach in public policy is believed to be restricted with general and abstract qualities (Anderson, 1994: 27). This is not an issue from the viewpoint of policymakers, however. The fundamental elements of the political system do not bother to open up the black box, and they may often be quite unwilling for any such action. In this regard, judging from the perspective of the actors of the political system, the systems analysis seems to be a good approach since it responds well to questions such as the nature of inputs that enable the sustenance of the system, the challenging pressure conditions brought about by inputs, environmental and systemic problems that constitute such pressure, and the place of outputs in problem solving (Saybaşılı, 1985: 26). It has certain shortcomings for social scientists, however, who want to open up the black box and look into the conditions under which policymaking takes place, that is, the events inside the political system. As a result, the attempts to open up the black box that begin in the '70s continue throughout the '80s and '90s (Jr, Hedge, & Lester, 2008: 96; Parsons, 2001: 77).

The Pre-1980 State Science Policy

In Turkey, the state has always resorted to science in certain areas, both before and during the Republican days. On the other hand, it is only in early '60s that science becomes a policy domain itself. Science policy is nothing more than a concept in many countries around that period. In the OECD's first Ministerial Meeting on Science, only four of the participating ministers actually represent a ministry relating to science and research. Science policy becomes more widespread in time, and in the third meeting, which takes place in 1968, all but a few countries are represented by a minister of science (Türkcan, 1981: 46). In Turkey's science policy move, the introduction of planned development plays a part along with an international trend. After all, science is not only part of the planning agenda or a policy headline but also an important instrument for good planning. Rational planning requires detailed research. The formation of staff and institutions to conduct research for public policy depends on the existence of a science policy. In this regard, important steps in science policy in Turkey include the emergence of science as a policy headline in the plans by the State Planning Organization (DPT), founded in 1960, and the establishment of the Scientific and Technical Research Council of Turkey (TÜBİTAK) to assume an active role in scientific work by the Institution's first five-year development plan (Göker, 2002: 2).

The first five-year development plan (1963 to 1967) sees research as the most efficient way to solve problems in the areas in which development is planned and covers the question of science under the "research" headline. It identifies the numbers of research staff present in higher education and the public sector at the time and offers calculations of research spending. It also lays down objectives to form a proper research environment, train staff, engage in building and equipment investments, and centralize the management of research activities (DPT, 1963). It is significant that in a country that has not been industrialized yet and is still developing, science policy aims to establish infrastructure needed for advanced research (Türkcan, 2009: 496). The single most important development in science policy around this time is the setting of the goal to found TÜBİTAK and the Social and Economic Research Institute to lead any research effort in technology and make relevant policy. While the Institute never comes to life, TÜBİTAK continues to enjoy its place as the main actor in science policy in the country today.

The second five-year development plan (1968 to 1972) identifies that many objectives in the previous plan could not be accomplished. Thus, it states the main goal in science policy to be eliminating structural shortcomings in research and building up manpower. Other important headlines include international collaboration to benefit from other countries' knowhow and collaboration between universities, industries, and the public sector to achieve technical sophistication required for domestic development (DPT, 1968).

By the third five-year development plan (1973 to 1977), neither international collaboration nor domestic inter-institutional coordination reaches the desired level. In addition, while the goal set by the first two plans is to send 6000 students abroad for graduate study, only 1181 (19.7 %) of them can eventually be sent. The budget share of research and development spending falls from 0.41 % in 1964 to 0.35 % in 1970. Therefore, the third five-year development plan diagnoses the main problem in science policy to be the inability to build research infrastructure and proposes new objectives accordingly (DPT, 1973). On the other hand, the fourth five-year development plan (1970-1983) states that the problems previously identified continue to trouble the scientific field and puts forward the criticism that TÜBİTAK fails to establish the necessary connections between the development plans and the science and technology system and to shift the domain of activity to industry (DPT, 1979). Indeed, TÜBİTAK has been founded to support research activities that would be the engine of development. In its first twenty-five years, however, it supports 2868 projects through its Research Groups, 2385 of which are eventually finalized, but only 180 ever come to life (TÜBİTAK, 1989). While it shares the goals specified in the previous plans, the fourth plan is a more critical text, but upon the changes in Turkish economic thinking introduced by the decisions of January the 24th, 1980, and the military intervention of September 12th, 1980, it loses all prospects of being implemented. One critical point suggested by the plan is that ambiguities exist in science policy (DPT, 1979: 48). In other words, it makes clear that setting goals relating to the budget share and the number of researchers only is an inadequate approach to science and technology. Thus, it is safe to argue that this period does not display systematic or consistent policy thinking but merely consists of the beginning of science policymaking. *Turkish Science Policy 1983 to 2003* (Şenses & Taymaz, 2003), which attempts to formulate science in the light of a certain system and is considered to be the first science policy document in Turkey, is born under such circumstances.

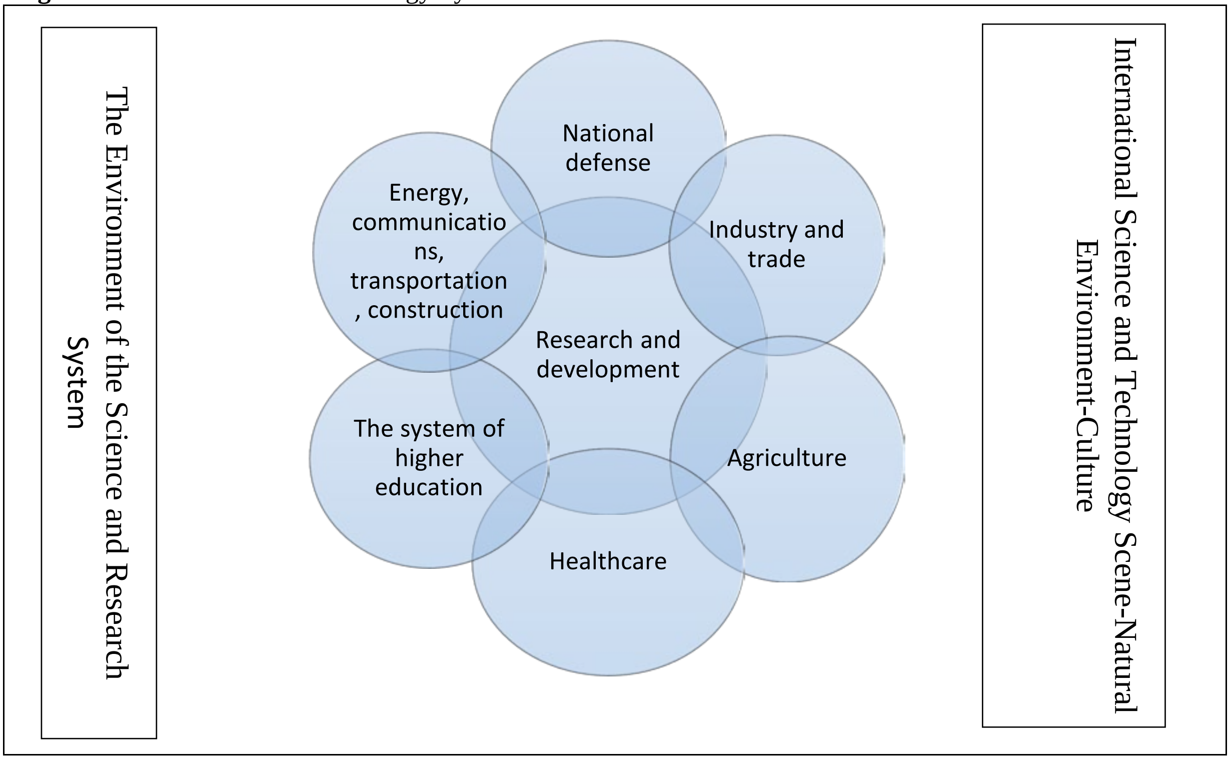
The Document *Turkish Science Policy from 1983 to 2003*

Turkish Science Policy from 1983 to 2003 consists of five main parts: (i) the importance of science policy, (ii) science history from Turkish-Islamic science to the 1980s, (iii) the systems approach, (iv) Turkey's science and research system, its problems, and international comparisons, and (v) Turkey's long-term science and research policy (The Department of State, 1983). For the purposes of this study, the document will be analyzed beginning from the part on the systems approach.

The third part of the document talks about the systems approach and the reason why it is chosen in methodology. According to this part, the main point of departure for science policymaking is that science is such an important area that we cannot afford to manage it without planning. The reason why the systems approach is embraced in science policy, on the other hand, is that this approach allows us to take science in all its aspects and circumstances. As much as science and technology, which is considered an open system, is in interaction with other policy domains, the problems resulting from this system are in interaction with the problems of society. The systems approach enables us to take the system as a whole, to focus on its parts, and to pay attention to the interaction among the parts rather than solely deal with each element individually. In other words, every output of the system can shape the actions of the system. This, in turn, makes the feedback control feature of the systems approach useful. This way, the science and technology system earns the ability to constantly adapt through feedback and develop policy accordingly. In this regard, feedback functions as a performance assessment system.

In *Turkish Science Policy from 1983 to 2003*, in the center of the science and technology system lie all research and development institutions. Close systems include industry and trade, agriculture, healthcare, higher education, physical infrastructure, and national defense. The international science and technology scene, the natural environment, and culture stand a little further in its periphery (Figure I). The document first examines Turkey's science and technology policy with its subsystems and environment and depicts it through both qualitative and quantitive indicators. Second, it diagnoses the problems and shortcomings of the current system and draws comparisons with countries that it takes as examples. Third, it sets the main goals and policies for future work. Lastly, it highlights the ways in which the science and technology system is connected with the close systems and specifies which areas should be prioritized.

Figure I: The Science and Technology System and Its Environment.



Source: Devlet Bakanlığı, 1983:29 (The Department of State, 1983: 29)

In assessing the science and technology system, six comprehensive indicators are defined, which are: institutional structure, manpower recruited in research and development, research and development spending, technological structure and sophistication, the information system, and external relations. The indicators stand in relation with one another. In other words, not only may development in one area affect other areas, but at the same time true progress is not possible without a shared development taking place in all areas. For this reason, first, the situation relating to each indicator is evaluated. As can be seen in Table I[1], these evaluations are made based on various sub-indicators. The sub-indicators, all of which are components of the science and technology system, are also each dealt with as a system by itself. This way, each subsystem provides important data concerning the indicators, based on which the problems of the science and technology system are identified using the method of international comparison. Comparisons are generally drawn with countries with sophisticated science and technology systems.

The problem assessments and the comparisons are followed by the last part, in which Turkey's long-term science policy is formulated. A detailed policy formulation is offered without breaking away from the systems approach. Before this is done, however, a general set of principles are defined for science and research policy, which apply for the entirety of the science and research system. This is important since it shows that the system has common goals. In other words, not only policies are made to eliminate the problems unique to each subsystem and move that subsystem forward, but at the same time, principles are set for the science and research system as a whole. The following are the principles defined:

- Science and research policy should constitute a dynamic system that tracks change well.
- Decisions in policy formulation and implementation should be made at the government level and have the same sanctioning force as development plans.
- Policy should be such as to contribute to national welfare and development.
- Policy should aim to deliver national technical self-sufficiency.
- Caution should be taken in seeking solutions to problems of a social nature.

[1] The table was created by the authors to show the indicators the document *Turkish Science Policy from 1983 to* 2003 uses to depict the science and research system, the evaluation criteria for these indicators, the evaluation methods and results, and the policies developed.

- Attention should be paid to make policy in agreement with economic development, put research results into application, absorb imported technology, and recruit qualified staff in fundamental and applies sciences.

In addition to these principles, five main goals are set for the entire system under the so-called “ideal to reach the level of contemporary civilization in science”:

- Raising the level of scientific development, and cultural enrichment,
- Increasing the impact of science and technology in economic and social development,
- Using science and research in defense force,
- Using science and research to contribute to the infrastructure and service sectors,
- Improving healthcare and welfare, and protecting nature.

Besides these main goals, 84 subgoals are defined across industries, which we will not go into here. Table I shows the main policies for each indicator. In addition, fundamental sciences, national defense research, and science and research areas by different industries are assessed, and policies are offered accordingly. The policies are made considering the then-current situation of the country.

Science Documents after *Turkish Science Policy from 1983 to 2003*

While *Turkish Science Policy from 1983 to 2003* leads to the formation of a Supreme Council of Science and Technology (BTYK) in line with international norms to make long-term policy in the scientific domain, the document is laid aside without ever being applied (Göker, 2002). The fifth five-year development plan, dated 1984, states that the science and technology masterplan set up by *Turkish Science Policy from 1983 to 2003* should be the main point of departure in science policy (DPT, 1984). In 1988, the State Planning Organization Ad Hoc Committee issues a report entitled *The Science, Research and Technology Masterplan*. Having been prepared by over 100 members from 8 subcommittees in 13 months, the report reviews the situation in Turkey and in the world at the time, the problems that exist in science, research, and technology, and the likely remedies. It highlights that the governments, research institutions, and universities have failed to remain faithful to the policy of guiding scientific research systematically for the purposes of social welfare, specified by *Turkish Science Policy from 1983 to 2003*. The report uses the six indicators in Table I and embraces the policies in *Turkish Science Policy from 1983 to 2003,* without adding a word, in certain areas. In addition, it makes occasional references to the document and uses much of its data dated 1983 (DPT, 1988). On the other hand, the report does not take *Turkish Science Policy from 1983 to 2003* as its main point of departure, and while it displays resemblance to the document, it was prepared using no specific model.

This report never finds application, either, and in its second meeting, which takes place in 1993, the Supreme Council of Science and Technology releases a report by the name *Turkish Science and Technology Policy from 1993 to 2003,* which depicts the situation in Turkey at time relying on data concerning the number of researchers, research spending and scientific publications. The “goals” part of the report covers concepts such as competition and innovation that reflect international developments (TÜBİTAK, 1993). On the other hand, it has a poor methodology in comparison to the document *Turkish Science Policy from 1983 to 2003*. *The Project for Advancement in Science and Technology,* which comes two years later based on the seventh five-year development plan and focuses directly on goals, manages to set goals that are in tune with its day, but it still fails to reach the same level of comprehensiveness as *Turkish Science Policy from 1983 to 2003* (TÜBİTAK, 1995). Nonewithstanding, the ‘90s is a decade that sees more initiatives in science and technology as opposed to the ‘80s (Göker, 2002: 10). Finally comes *The National Science and Technology Policies 2003 to 2023 Strategy Document / Vision 2023,* which is in effect today. *Vision 2023* appears closer to *Turkish Science Policy from 1983 to 2003* in methodology. Having been prepared in a period of over two years beginning in 2002, this document is the product of 250 experts, 192 meetings, and 36 panel meetings and workshops. For its technological forecasting work, 7000 experts were sent surveys, 2400 of whom returned a response. The report portrays the existing situation and offers roadmaps for policies, strategies, and goals in the areas likely to bring the country more competitive power (TÜBİTAK, 2004). While it does not mention the systems approach or any other method, *Vision 2023* does not overlook the subsystems that make up the science and research system in *Turkish Science Policy from 1983 to 2003*. The other documents mentioned above demonstrate a similar approach as well. In other words, not only is *Turkish Science Policy from 1983 to 2003* Turkey’s first comprehensive science policy, but at the same time it has invented a tradition influencing all later policy documents.

Conclusion

Turkish Science Policy from 1983 to 2003 was the product of Turkey's efforts to catch up at a time when it found itself staying behind the developments in science policy since the field's emergence in the '60s until the '80s. Previously, the development plans set goals relating to research spending and the numbers of researchers, but a comprehensive science policy never came into being. TÜBİTAK, which was founded in the '60s to be an important actor in science policy and conduct research in fundamental sciences, failed to play an active role. However, in Germany, for instance, where similar points were being made, the policy to spread an interest in fundamental sciences among youth brought about a great advancement (Altuğ et al., 1997). *Turkish Science Policy from 1983 to 2003* was prepared with the idea that the country could not afford to remain behind in the world scientific system anymore.

The document uses the systems approach to formulate science policy objectives. It considers science and research to be in connection and interaction with one another and with their environments so much so that the two make up a single whole with their structures, functioning, and relations. Departing from this, it relies on a detailed study to identify the issues particular to the country's conditions and propose different policies for each headline. *Turkish Science Policy from 1983 to 2003* aims at policies that are legitimate and up-to-date in its time. This document designates technological fields like electronic engineering, computer science, instrumentation, and telecommunications as the areas to be given first priority in development. While South Korea, which adapted the Japanese program to herself and came up with similar projections, made significant advances, Turkey eventually put aside whatever work it was planning to carry out during the same period (Göker, 2002). The policy documents could not be implemented, either, with the exception of *Vision 2023,* which is currently in place. Not only did many initiatives attempted during this period fail to be as comprehensive as *Turkish Science Policy from 1983 to 2003,* but at the same time they lacked a clear approach.

The most critical aspect of *Turkish Science Policy from 1983 to 2003* is that it has been the most detailed science policy document up to its day, and it has taken quite long for another study with such careful science policy planning to follow. Also important is that no similar work can be encountered in other public policy domains. In addition, the document has handed down an approach to science policy, which, while it has not often been used in later science policy documents, sees science and research to constitute a single system.

Table 1: The Roadmap for Science and Research Policymaking

Indicators Used In Determining the Level of the Science and Research System	**Institutional Structures and Their Current Situation**	**Manpower Employed In Research and Development and Its Current Situation**	**Research and Development Spending and Its Current Situation**	**Technological Structure and Its Current Situation**	**The Information/Documentation System**	**External Relations**
Evaluation Criteria	Universities	Researcher	Research and development spending per capita	Industry	Scientific information	Bilateral collaboration
	Institutions affiliated with the Office of the Prime Minister	Technician and equivalent	Research and development spending per researcher		Technological information	Multilateral collaboration
	Agriculture, forestry, veterinary medicine, and livestock farming research	Other support personnel	Total research and development/GDP		Socioeconomic information	
	Other research structures under Ministries					
	Private sector research institutions					
Evaluation Results and Method	**Issues**	**Issues**	**Issues**	**Issues**	**Issues**	**Issues**
	-Goals unclear. -Necessary size yet to be reached. -Insufficient collaboration. -Inadequate accumulation of knowhow. -Lack of equipment. -Administrative issues.	-7 times increase in research and development staff needed. -Low numbers of researchers in private sector. -Education system cannot meet needs. -Wrong wage policy.	-Insufficient research and development funding.	-Low levels of coordination between science and technology. -Technology transfer needed in intermediary and investment goods industry.	-Insufficient training and public awareness. -Weak government support. -No structure to coordinate. -No information network. -No connection with international system.	-Ambiguities and irregularities in collaboration.
	International Comparison	**International Comparison**	**International Comparison**	**International Comparison**	**International Comparison**	**International Comparison**
	Germany, France, Japan, Spain	Germany, France, Japan, Britain, USA, USSR	21 countries	USA, USSR, France, Japan	Germany, France, Japan, Spain, Brazil	
The Long-Term Science and Research Policy Determined	Body to carry out judicial functions	Increasing number of staff	University research funding	Technology transfer	Informations training	To make bilateral agreements
	Body to carry out executive functions	Improving staff quality	Public sector research funding	Technological innovation incentives	Planning in national information system (scientific, technological, and socioeconomic)	Following universal developments closely
	Body to constantly monitor science policy	Sectoral distribution to be done in situ	Private sector research incentives	Active and efficient use of technologies transferred	Connections with international information system	

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