

**NATIONAL PLAN
FOR SCIENTIFIC RESEARCH
TECHNOLOGICAL DEVELOPMENT
AND INNOVATION**

2000-2003

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Volume 1

Objectives and Structure



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**National Plan for Scientific Research,
Technological Development
and Innovation**

(2000-2003)

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Presentation

Science and Technology policies are of fundamental importance in the development of modern societies, as there is a direct relationship between the innovative capacity of a country and its competitiveness. They can also be considered as horizontal policies, which may and should underpin and help to contribute to the development of other different public sector policies (Education, Health, Environment, etc.) and to improve the welfare and quality of life of the citizens, which is the ultimate aim of all public policies.

The mission of the State Administration should be, on the one hand to reinforce basic research, which is a fundamental element in the generation of knowledge and the basis for all long-term development and, on the other hand, to encourage enterprises to become fully involved in the culture of technological innovation with the aim of increasing their competitiveness. The importance of R&D policy has been emphasised repeatedly in the last few years in order to consolidate sustained long-term growth as a contribution to economic development. The increase in the public budget should also contribute to stimulating the participation of private sector in R&D activities. In this respect, the aim is to correct and even to reverse the downward trend in enterprise R&D effort, which in 1997 represented less than 50% of the total Spanish R&D expenditure. For this purpose it is necessary to develop policies which while favouring, in general, scientific research, technological development and innovation activities (R&D&I) also improve the co-ordination of the scientific and technological tasks between the public and private sectors, thereby improving not only the quality of the research but also the value of its applications.

The last-mentioned objective should receive special attention owing to the fact that the Spanish Science-Technology-Enterprise system, as in the whole of Europe, suffers from a lack of practical applications, generated from the knowledge obtained through research. This phenomenon is known as the "European Paradox". It is therefore essential for our productive sectors to take maximum advantage of the efforts made in applied research. Obviously, at the same time we should not lose sight of the capital importance of basic research, which is an inexhaustible source of that knowledge which we want to take advantage of.

The Law 13/1986, of Promotion and General Co-ordination of Scientific and Technical Research, established the National Plan for Scientific Research and Technological Development for the Stimulation and the General Co-ordination of Scientific and Technical Research, which corresponds to the State. It also created the Interministerial Commission for Science and Technology (CICYT) as the body responsible for the planning, co-ordination and the monitoring of the National Plan. So, the National Plan was conceived as a mechanism designed to integrate several different elements, and which had to determine the principal objectives in R&D for multiannual periods and to organise the research activities into programmes to be carried out by those ministerial departments with responsibilities in the relevant areas.

The efforts that have been made since the approval of the first National Plan in 1988 have improved notably the Spanish Science-Technology-Enterprise System, increasing the capacity of the public R&D system and opening it up to the productive sectors. However, in practice, the National R&D Plan has only integrated part of the activities of the State Administration and therefore only a part of these activities have been subject to the tasks of planning, co-ordination and monitoring which correspond to the CICYT. This situation has made it difficult to have a global strategy in R&D&I policy.

The need to advance in the process of co-ordination and integration of the different bodies dependent on the State Administration entailed a reorganisation of the state R&D&I policy planning bodies.

The Royal Decree which created the Office for Science and Technology (OCYT) in January 1988, established among the functions of the Office that of providing assistance to the CICYT for the performance of its functions of planning, monitoring and evaluation of the priority lines of the scientific research and technological development and innovation policy, financed from the General State Budgets.

Similarly, in the new context of European Integration resulting from Economic and Monetary Union and with the current growth of the Spanish economy, Spain should continue increasing its investment in R&D&I activities and make a special effort of convergence to improve its position in the European arena of Science and Technology, trying to find synergies with the activities of the R&D Framework Programme and with the Structural Funds of the European Union.

The National Plan for Scientific Research, Technological Development and Innovation for the period 2000-2003 corresponds, as its new name implies, to the concept of a National Plan as defined in Chapter I of the Law 13/1986. Its change of name corresponds to the objective of defining a global strategy to include all the public activities managed by the various ministerial departments with responsibilities in R&D and which are financed directly from the General State Budgets or by other extra-budgetary means (such as the Structural Funds of the European Union, or the reimbursement of credits granted to companies, etc.). The National Plan then includes all the activities in this field from basic research to technological innovation. The State policy in R&D&I should now be regarded from this new approach, which encompasses all the activities of the State administration within a common strategy, which materialises in this National Plan for Scientific Research, Technological Development and Innovation. This plan is the instrument for the scientific and technological policy of the State administration with the aim of boosting the development of the Spanish Science-Technology-Enterprise System.

In this process of defining the National Plan, there has been the active participation and collaboration of the ministerial departments, the public research bodies and the Autonomous Communities, in order to make sure that their strategic priorities were adequately established. As well as these bodies, there have been experts, from different areas who guaranteed a correct identification of the priority areas and of their thematic lines.

This document has been arranged in two volumes. The first one includes all the details concerned with the global structure and the strategic objectives of the National Plan. The second one develops the thematic priorities and the socio-economic objectives in the area of non-targeted basic research, the scientific-technological areas and the sectorial areas, together with their corresponding strategic actions.

Introduction

1

The preparation of a **National Plan for Scientific Research, Technological Development and Innovation** (abbreviated as NP) provides an excellent opportunity for the country to examine its own strengths and weaknesses and to project into the future the basic strategic role which the NP should play in its economic and social development. It is thus an opportunity to begin the new century with scientific research and technological development and innovation occupying a leading place in the list of national priorities.

In the preparation of the NP diverse analyses of the Spanish Science-Technology-Enterprise (S-T-E system) have been undertaken, which have made it possible to identify the strengths and weaknesses in the existing system, as well as the possible reasons for the difficulties in the harmonious development of the S-T-E system. This last was the fundamental objective of the Law 13/1986, as stated in article 2.a). In this context, the National Plan, as the science and technology policy instrument of the State administration, should serve as a framework of reference for the improvement of the S-T-E system, thereby adapting its structure and priorities in order to meet the needs of our society.

This document establishes the basic elements of the National Plan for Scientific Research, Technological Development and Innovation for the 2000-2003. Based on the analysis of the S-T-E system, it goes on to present the strategic objectives of the NP and derives from those objectives its structure. These then lead on to the establishment of the structure of the plan itself.

The NP has thus been conceived with an integrated approach that aims at providing the State Administration with a basic instrument of scientific and technological policy, in which all scientific research, technological development and innovation activities are included and financed partially or totally out of the General State Budgets.

Figure 1 shows graphically the scope of the NP, using the OECD Manuals of Frascati and Oslo as a reference. The activity framework of technological innovation is shown, taking into account the fact that the framework of innovation in general may be much wider. Figure 1 also suggests that there are aspects of scientific research which exceed the field of activities of technological innovation and even that of innovation on its own. At the same time the objective of scientific research, which is to generate new knowledge, does not necessarily have to be linked to processes of innovation in the productive sectors.

For the purposes of the NP, technological innovation is the process by which new products, processes or services are obtained as well as technological improvements in already existing products, processes or services. A technological innovation can only be considered as concluded when the new or improved product or service has been put on the market or when the new or improved process has been used in

Figure 1
Activity framework for
technological innovation



production. Innovation should be seen not only as the final result of the processes of scientific research and development but also as a first step to encourage enterprises to acquire the habit of research. Other aspects of innovation such as organisational or commercial innovations are outside the scope of the NP.

On the other hand, research and development includes activities, which are undertaken systematically to increase scientific or technological knowledge or to find new ways to apply such knowledge.

It is important to realise that this is the first time in Spain that the needs of the S-T-E system has been approached from the standpoint of an integrated system of technological innovation, in which R&D activities play a fundamental, though not unique role.

In order to shape the structure of the NP three distinct but complementary axes have been considered.

- **The thematic axis**, in which the activities necessary for the definition of the priority areas and their thematic lines are developed.
- **The instrumental axis**, in which the modalities of participation of the different actors of the S-T-E system in the activities of the NP and the corresponding financial instruments are determined.
- **The budgetary axis**, in which the economic scenario is determined and, derived from this scenario, the available funds for each of the areas and type of activities in the NP are allocated.

Considering the above, the **structure of the National Plan** is understood as:

- the basic elements of the areas which will be the object of priority attention, based on the criteria which sustain its contents, and the scope covered by each one of these areas and their objectives;
- the horizontal actions of the NP, whose application exceeds the scope of an area;
- the way in which these areas and the horizontal actions are mutually related;
- the identification of the different types of actions in scientific research, technological development and innovation (R&D&I) which are planned for the various areas, through different modalities of participation with their corresponding financial instruments;
- the way in which it is proposed to manage the NP, from an integrated and dynamic perspective so as to assure its relevance and importance throughout its period of operation;
- the mechanisms for the monitoring and evaluation of the activities, which are financed through the NP;
- the procedures for co-operation and co-ordination with the Autonomous Communities during the execution of the NP.

Moreover, the NP, in accordance with article 5 of the Law 13/1986, will be accompanied by fiscal and regulatory measures, which will not only encourage enterprises to undertake R&D&I activities but will also create conditions favourable to companies, so that they increase their investment and participation in these type of activities.

Analysis of the Spanish Science-Technology-Enterprise System

2

It must be mentioned that first of all, after Law 13/1986 was enacted, the Spanish S-T-E system has since strengthened notably. The effort made through National Scientific Research and Technological Development Plans (and its integrated sectorial programmes) in their first two phases to establish and elevate the capacity and quality of the Public R&D System, and the consolidation and opening to the productive sector that the Third National Research and Development Plan meant, can be praised.

On the other hand, the action taken by different ministerial departments to technologically strengthen Spain's productive sector in the strategic sectors of its economy, which until now, were not integrated in the national plans, allows to seek more ambitious objectives for this new National Plan.

This, however, does not prevent there being certain weaknesses in the Spanish S-T-E System, which must be corrected, in addition to consolidating the effort made since Law 13/1986 was enacted.

Based on the different analyses carried out over the past few years, some aspects have been identified that seem especially relevant and that must be tackled in the National Plan. They are:

- 1** - The size of the Science-Technology-Enterprise System.
- 2** - The technological level and the appreciation of technology and innovation processes by Spanish enterprises.
- 3** - Technology transfer mechanisms and dissemination of results.
- 4** - Adaptation of the Public R&D System to meet the demands of the productive sectors.
- 5** - International presence of Spanish science and technology.
- 6** - Support to the financing of technological innovation activities of enterprises.
- 7** - Evaluation and follow-up procedures of the financed actions.
- 8** - Scientific-technical culture of Spanish society.

Each one of the aforementioned aspects gives rise to a number of derived problems that are described below.

2.1 The size of the Science-Technology-Enterprise System

Spain has a relatively small S-T-E System in relation to its economic position in the world context. Both regarding the percentage of the Gross Domestic Product (GDP) spent on Research and Development (0.86% in 1997) as well as the number of researchers (3.3 researchers per 1,000 active members of the population in 1997), Spain is clearly below the mean of other European countries with an economy on its same level.

The business sector share in Spain's Research and Development expenditure (which was 49% of the total R&D expenditure in 1997, according to the latest official information available) is also less than that of the other European countries, and so is that of the number of researchers in the business sector. Additionally, dependence on foreign technology is very high; Spain has higher technological dependence than it should have in comparison with, for example, its contribution to the EU budget, which is 7.2%. This technological dependence is also an effect of the small number of innovative companies (less than 12% of the total).

In view of this data, it is obvious that technological innovation in its broadest sense or more specifically in the field of science has historically not been sufficiently appreciated by Spanish society (neither the public powers, nor Spanish society as a whole).

The gradual increase of public funds destined to R&D&I will contribute towards changing this situation. The change must take place continuously and with long-term objectives, so that the required change of mentality in Spanish society takes place and is consolidated.

2.2 Technological level and appreciation of technology by Spanish enterprises

The general competitiveness of the productive sectors over the next few years will depend, among other factors, on the management of technological resources. However, the current technological level of Spanish companies is, in many sectors, notably below that of its competitors internationally, and this factor is of great relevance in the case of small and medium-sized companies, which are forced to enter the international markets both to compete with their products, processes or services, and to have access to the technology required. Likewise, the companies do not tend to sufficiently appreciate technology as a key element to assure their competitiveness. Thus, for example, the percentage that represents added value from high technology activities of the total, is 7% in Spain, compared to 10% in the European Union, and the percentage of companies that carry on R&D activities is only 3.4% of the total.

There are two consequences as a result of this:

- **There are few Spanish enterprises that continuously carry on R&D&I activities.** This factor is even more determining in the case of small and medium-sized companies, which do not usually have a stable structure for R&D&I activities. In general, before taking on new technology, which is the key of the technological innovation process, they wait until the technology has matured, thus reducing the risks arising from its early absorption, however preventing themselves in this way from occupying privileged positions. Moreover, they barely have relations with public research centres, and the conditions they require to establish long lasting medium and long-term relations do not exist.
- **The absorption of emerging competitive technology** that allows to rapidly improve the added value of new products, processes and services is a fundamental need. In general, projects financed

through the General State Budgets (GSB) have tended to be concentrated on the development of new products, technology or knowledge (in the form of different types of R&D projects), and have been directed in a lesser extent, to identify, evaluate, select, acquire, adapt and incorporate new technology into the productive processes of the companies and improve their competitiveness through this process.

These aspects are especially important at a time when it is no longer possible to compete on the international markets solely in terms of labour costs, instead it is necessary to increase the added technological value of processes, products and services.

Technology transfer mechanisms and dissemination of results

2.3

In order to make the best use of the activities financed through the GSB, it would be desirable that, as far as possible, the results of the R&D activities carried out by the public sector could be used by the business sector. However, the interaction mechanisms currently used in the R&D public sector and the productive sector of the country are still scarcely efficient. The following may be used as an example of this situation:

- In spite of the growing activity that Offices for the Transfer of Research Results (OTRI) and other private foundations have carried out over the last few years to channel the offers of public centres, **it is still a priority to increase the transfer of results**, channelling the demand of the productive sector towards public centres. Co-ordination of the activities of the National Plan (NP) with private foundations is scarce. The mobility of human resources between the public and private sectors is also scarce, in spite of a general consensus on its importance to accelerate the adoption of new processes or products.
- A large part of the **results of R&D projects financed through public calls for proposals do not reach the market**. Even in cases in which there is technical success, very rarely is the industrialization and subsequent commercialization process carried out.
- **Different types of actors do not normally co-operate in R&D projects**, instead each type of actor (companies, state research centres, etc.) usually have separate and independent participation modalities. It is consequently difficult for the different actor to establish stable and complementary relations, thus making it difficult to articulate the S-T-E System. However, this type of co-operation is known and used by R&D groups and enterprises at European level.

Adaptation of the public R&D System to the needs of the productive sectors

2.4

From a structural point of view, Spain's public system tends to perpetuate the existence of small groups, due to the need of individualized promotion and the absence of incentives for the creation of larger groups or groups that are more strongly interrelated, which makes it difficult to carry out R&D projects that require a larger critical mass. This problem is theoretically minor in the case of Public Research Centres, in which it is possible to establish priorities that concentrate the resources available, or in basic research activities, in which the generation of knowledge processes do not have the same requirements.

As a result of this:

- **There is a lack of adaptation between the offer of R&D groups of the public sector and the technological demand that the enterprises require of them.** This situation is due, on the one hand, to the existence of a relatively large number of basic R&D oriented groups, whose activity does not have to have a short-term effect on needs of an industrial nature and, on the other hand, of more applied groups, in which the selection of topics to undertake is not established by the needs of Spanish enterprises. When there is a demand for technology or for new knowledge by the enterprises, this demand may not be attractive for public sector R&D.
- **The low number of human resources available in Spain's public sector R&D groups and the scarce motivation there is to constitute R&D groups** with the required critical mass, makes it difficult to carry out strategic projects that require a high number of scientists and technologists (both in the public and private sectors) to cover their objectives. Additionally, the bad distribution and lack of mobility of researchers and auxiliary staff must be taken into account. On the other hand, the determination of priorities for the training of R&D human resources has not always been closely related to the thematic priorities related to activities financed through public calls for proposals.
- **Little use of consolidated groups and difficulties in the creation of multi- and interdisciplinary groups.** Spanish R&D groups tend to carry out their activities in fields that are closely related to their area of knowledge, with very little contact with groups of other areas. This situation is brought about in part, by the need for personal promotion and the relative loss of influence that is obtained on tackling problems of a more general nature. On the other hand, interdisciplinary activities are neither encouraged through R&D project evaluation mechanisms, nor through promotion systems of scientific or technological personnel at Public Research Centres. For all these reasons, existing consolidated groups are very rarely used as motors of innovation and growth of the S-T-E System.

2.5

International presence of Spanish science and technology

The credibility of the science and technology system of a country is also measured by its capacity to participate in the generation of knowledge at world level, regardless of the economic returns that result from it. In the case of Spain, this visibility is reduced as there are no important scientific or technological areas in which Spain is leader, despite the increase in Spanish publications on international databases (2.37% of the total during 1993-1997, which places Spain in an adequate position given its economic weight). Likewise, there is a great difference between some areas and others, which makes it difficult to act uniformly.

On the other hand, the boosting of this international relation has not been prioritised in the projects financed through national programmes. On the contrary, these programmes have been established fundamentally from a purely national viewpoint, at a stage where the activities outside the borders of Spain have a leading role and it is more and more important to establish stable relations with other countries, both at government, institutional or personal level.

As a result of this:

- **There is little participation in large international R&D projects.** This situation, in many cases due to the historical reasons linked to Spanish isolation, is typical in the case of large-scale facilities linked to multinational bodies, and corresponds to the little presence in management bodies, in the subordination of the subjects of interest dealt with by them, and little support at

national level that would allow to make the best use of Spain's participation (for example, with specific mobility programmes).

- **The NP does not decidedly support the internationalization process of R&D projects in Spanish companies.** In this sense, the public R&D system has remained on the sidelines in this process.

Support to the financing of the technological innovation activities of companies.

2.6

Activities financed by the different ministerial departments have been focused on the development of R&D projects or on complementary actions that would facilitate its execution (such as training or the acquisition of equipment). The broadest concept of "technological innovation" has not been explicitly present. The result is thus:

- **Little relevance of the technological positioning actions taken by enterprises.** Specifically, they have not been considered a priority, for example, activities that have tended to incorporate technology in business organizations, fundamentally small and medium-sized enterprises, or the demonstration of the use of advanced technology to accelerate its use in certain sectors.
- **Little mobilisation of private venture capital funds towards technological innovation projects,** given the little experience and the need to assume high technical risks.
- **Little use of the tax benefits** established in the Enterprise Tax Law in relation to R&D&I activities.

Evaluation and follow-up procedures of the financed project

2.7

Any public financing system of R&D&I activities must be based on efficient management of the resources that the citizens place at the disposal of public authorities. Management of the activities that are financed on account of the General State Budgets requires adequate human and material resources to be available in the managing bodies.

In Spain, the means traditionally devoted by the State Administration to evaluate and follow-up projects and scientific and technological policies have been scarce. Consequently, the following has occurred:

- **Emphasis on administrative follow-up, based fundamentally on economic aspects** of the use of the aid. The little weight of the technical follow-up weakened the perception of the interest of the administration on what it finances and makes it difficult to really know what is happening. This situation is due to the lack of a sufficient number of technical administrators and to the excessive dispersion of resources in activities with low financing. As a result of this, there is reduced knowledge by CICYT about the use of the results obtained from the project that has been financed.
- **Difficulty to carry out a pro-active management.** Although it is true that a different approach is taken in some participation modalities, the basic concept that is generally applied in the management of the activities related to public calls for proposals and by the different management bodies is reactive, i.e., there are reactions to the proposals submitted for their consideration by the different proposing actors. The result is the lack of a catalytic, dynamic or mobilising role of the activity that facilitates the positioning or reorientation of the R&D groups or of the enterprises and that allows anticipating the required activities.

2.8

Scientific-technical culture of Spanish society

It is not an exaggeration to say that part of the deficiencies found in the S-T-E System are the result of the low scientific-technical cultural education of all the sectors that form Spanish society. Consequently:

- In Spain, **researchers and the research centres themselves have little interest** in informing society of the results of research activities and in showing their importance, thus raising the science and technology culture level. This has led to a society with a low level of scientific-technical knowledge and little support to research as a generator of knowledge and useful innovations to increase society's well being and economic activity.
- In Spain, **the media pays little attention to the diffusion of scientific and technological knowledge**, or to informing on innovations that are relevant to the business sector. There are very few scientific journalists and the university faculties Journalism direct students towards other areas of information with greater acceptance. The educators themselves are not sufficiently familiar with science and technology and do not have adequate pedagogical material for primary and secondary teaching levels.
- The **citizens do not adequately appreciate scientific activities** and as consumers, they do not have an adequate level of demand and of information on products that involve technology.

Strategic Objectives of the National Plan

3

Following the present orientations of scientific and technological policies, the NP should be based on the following general principles:

- to be at the service of the citizen and the improvement of social welfare;
- to contribute to the improvement of entrepreneurial competitiveness;
- to contribute to the generation of knowledge.

If the last of the principles indicated may be considered as implicit in the activities that are developed in each one of the areas, the first two principles should be expressed concretely in operating principles applied to all the activities.

The deficiencies that have been mentioned under the previous heading are complex and inter-related. The solution to them requires not only the implementation of various measures but also that the solution applied should be prolonged sufficiently to produce the structural changes required (and possibly adapted depending on the results obtained); in reality it is not feasible to obtain substantial changes in the S-T-E system in the short term; the most important thing is that the changes should happen slowly but continuously, so that the actors of the system are able to adapt to the changes gradually.

Moreover, employment policy is one of the basic priorities of the Spanish Government, and its objective is not only to increase the labour force, and thus reduce unemployment, but also to improve the quality of existing employment.

R&D&I policy, for which the NP is a fundamental tool, could therefore not be dissociated from the objectives of the national policy on employment.

Independently of the socio-economic activities of R&D&I which belong to the areas of the NP, the NP as a whole should contribute to a climate favourable to the creation of employment linked to innovative activities through the adoption of appropriate measures. In this way, the NP should play an important role in the creation of high quality employment, not only through its role in improving human resources (through training, mobility and hiring) but also through its objective of encouraging an innovative industrial tissue.

Based on an analysis of the S-T-E system and of the general principles of the NP the following strategic objectives are proposed:

- 1 - To increase the level of Spanish science and technology, both as regards its size and its quality.
- 2 - To increase the competitiveness of the enterprises and to encourage their innovation capacity.
- 3 - To improve the exploitation of the use of the R&D results by the enterprises and by Spanish society as a whole.
- 4 - To strengthen the internationalisation of Spanish science and technology.
- 5 - To increase the qualified human resources both in the public and the private sectors, with special emphasis on the latter, while at the same time encouraging mobility among the personnel of the different centres.
- 6 - To raise the level of scientific and technological knowledge of Spanish society.
- 7 - To improve the co-ordination, evaluation and technical monitoring procedures of the NP.

Each one of these objectives reflects, from the perspective of the NP, the policies of the State in its widest sense. The action on R&D&I represents one of the dimensions of those policies and reflects the idea that they are an instrument at the service of public policies. It is precisely that character of service which confers R&D&I the relevance which it has at the present time in modern states and to which the NP should contribute.

3.1

To increase the level of Spanish science and technology, both in quality and in quantity

The basic objective is to increase the size of the Spanish S-T-E system in terms of number of researchers and experts in technology and in number of innovative enterprises and R&D centres so as to achieve a substantially higher percentage of the GDP spent on R&D. It will only be possible to reach this objective if the sums of money devoted to the public sector are increased slowly but appreciable, while at the same time private investment in technological innovation is made more economically attractive, and all of this maintaining the scientific-technical quality of the financed activities.

In more explicit terms, the objectives are:

- To reach an expenditure on R&D of 1.29% of GDP by the year 2003.
- To increase the participation of the enterprise sector in R&D expenditure until it reaches 65.3% of the total.

The increase in public investment and the fiscal measures which accompany the NP should favour **an increase in R&D&I investment by enterprises**, whose low level of investment has been pointed out repeatedly as one of the principal causes of the scarce Spanish influence in the international context.

Finally, it is necessary to increase the economic and human resources of the management bodies of the programmes of the new NP for the activities of evaluation, monitoring and promotion.

3.2

To raise the level of competitiveness of the enterprises and to encourage their innovation capacity

The raising of the technology level of the Spanish enterprises must be considered as a basic objective of the NP. This will bring two types of benefits to the S-T-E system: firstly, a greater technological component in the products and services generated by Spanish enterprises, that will reinforce their competitiveness, and secondly, a greater interaction with the public R&D sector.

Besides, it is also necessary to reinforce the innovative character of the productive sector. In this respect, the general objective is to provide the S-T-E system with financial instruments and fiscal and regulatory measures which allow the enterprises to accelerate the incorporation of new technologies and the creation of new technology-based enterprises. This will also favour the interrelation between the productive sector and the technology centres.

Moreover, it is necessary to increase the appreciation of the technological innovation activities by the productive sectors, providing the enterprises with adequate mechanisms for the efficient incorporation of innovative processes and technologies in their activities. Technological innovation is the guarantee of survival in the future for enterprises in a competitive environment. It is thus essential that the adoption of the most suitable technological processes should be accompanied by the efficient management of human resources, while at the same time the enterprises should emphasise improvements in service and in quality.

To improve the use of the R&D results by the enterprises and by Spanish society as a whole

3.3

The general objective of the NP in this respect is to support the interrelation and articulation among the different actors of the S-T-E system in the short, medium and long terms, so that each one of them can profit from the efforts of the others, thus making a more efficient and effective use of public resources. The valorisation of the efforts made in R&D requires the link as far as possible of basic research to applied research and technological development.

This strategic objective should be accomplished through and increasing effort in the prioritisation of the activities of the NP, as well as the focusing on the resources available in a limited set of activities endowed with necessary resources.

In this way, the NP should make it easier for the more applied research activities, carried out by the R&D groups in the public sector, to be brought gradually closer to the needs of the productive sectors, while at the same time maintaining the quality of these activities. Moreover, the efforts of the researchers from various disciplines and areas should be combined for the development of more complex and ambitious inter-disciplinary R&D projects.

To strengthen the internationalisation of Spanish science and technology

3.4

The planned objective is to increase the Spanish presence and leadership in international R&D programmes, especially in those activities that arouse the interest of both the public and the private sectors, or on those programmes of experimental basic research. Spain's increased presence should also lead to the signing of multilateral or bilateral agreements with other countries.

There is also the wish to increase the number of international activities that are performed in Spain, being either specific, or through centres of excellence or technology centres, in collaboration with other international R&D centres.

From the point of view of the enterprises, the aim is to increase the co-operation among enterprises in international R&D activities, while, at the same time, seeking the support of the public R&D system in these activities and improving the Spanish position in international programmes, such as the EU Framework Programme.

3.5**To increase the qualified human resources both in the public and the private sectors**

The increase in the economic resources to finance the activities of the NP may not be sufficient to reach the declared objectives if there is not a sufficient number of qualified human resources.

This increase, however, should be considered from a global perspective, which combines the absorption capacity of the S-T-E system with the need to maintain the critical masses required. It is important to highlight the fact that the personnel excess in some disciplines does not meet the needs of highly qualified personnel in the productive sectors for which the number of trained personnel is not enough.

The aim is to increase the number of new modalities of participation, which will allow an increase, through renewable contracts, of the number of researchers available in the priority areas and at the same time to facilitate the mobility of research personnel among institutions in the public sector and between this last and the enterprise sector.

3.6**To raise the level of scientific and technological knowledge of Spanish society**

The general objective is to provide the research centres and the interface units with the resources to carry out dissemination and cultural diffusion activities, and implementing instruments to attract people to science and technology, especially students, entrepreneurs, and media personnel thus making Spanish society aware of the achievements in this field.

3.7**To improve the coordination, evaluation and technical monitoring procedures of the NP**

The general objective is to provide the management bodies of the different activities of the NP with harmonised procedures for scientific-technical evaluation and monitoring, paying special attention to the thematic co-ordination among areas within the integrated concept of the NP.

On the other hand, the Law 13/1986 set out in article 6, the possibility of including in the NP, depending on its interest, the R&D programmes of the Autonomous Communities, which are financed totally or in part from State funds. The coordination with the R&D&I plans of the Autonomous Communities is carried out through the General Council for Science and Technology, whose functions, established in article 12 of the already mentioned Law 13/1986, are to assure the coordination between the activities of the NP and those of the Autonomous Communities. These co-ordination processes should be strengthened by the establishment of explicit agreements between the State Administration and the Autonomous Communities within the framework of the NP.

Indicators associated with the strategic objectives

3.8

Depending on the strategic objectives established by the NP, the desired values for a series of indicators for the Spanish S-T-E system have been established, based on the latest official data available.

Indicators of economic resources	1998	2003
Expenditure on R&D as a percentage of GDP	0,95	1,29
Expenditure on R&D&I as a percentage of GDP	1,55	2,00
% of business expenditure on R&D	49,1	65,3
% of innovative enterprises	12	25
Creation of new technology-based enterprises from public R&D centres and technology centres	-	100

Table 1
Indicators associated with strategic objectives

Indicators of human resources	1998	2003
Number of researchers per 1000 labour force	3,3	4,0
% of researchers in the enterprise sector	23	27
R&D Personnel per 1000 of active working population	5,5	7,0
% of R&D personnel in the enterprise sector	37	44
New contracts and research positions in the public R&D system	-	2.000
Insertion of PhD holders in the enterprise sector	-	500
Insertion of technologists in SMEs and Technology Centres	-	1.000

These indicators should be the explicit object of the evaluation and monitoring activities of the NP. The possible deviations from these, and the analysis of the reasons for these deviations and the proposals for the corrective measures to be taken, should all form part of the process of dynamic evolution of the NP, and will be carried out annually.

Structure of the National Plan

4

Context of the National Plan

4.1

The NP should take into account the need to combine two basic elements in its structure:

- The advances in science and technology, which have contributed to the generation of new knowledge in different priority areas and that maintain the intellectual and productive and material progress of our society.
- The demands of some sectors of Spanish society for the improvement in the competitiveness of enterprises and of the social wellbeing.

All of this within the general framework of the globalisation of scientific, technological and economic activity, as well as of European integration in which the NP should reinforce or complement, according to the cases, the activities of the European Union, in particular the **Fifth R&D Framework Programme (FP5)** and the activities financed from the Structural Funds. At the same time, it will be necessary to take into account the initiatives of the Autonomous Communities through their **Regional Plans for R&D** or other equivalent instruments. Figure 2 shows the context of the activities of the NP.

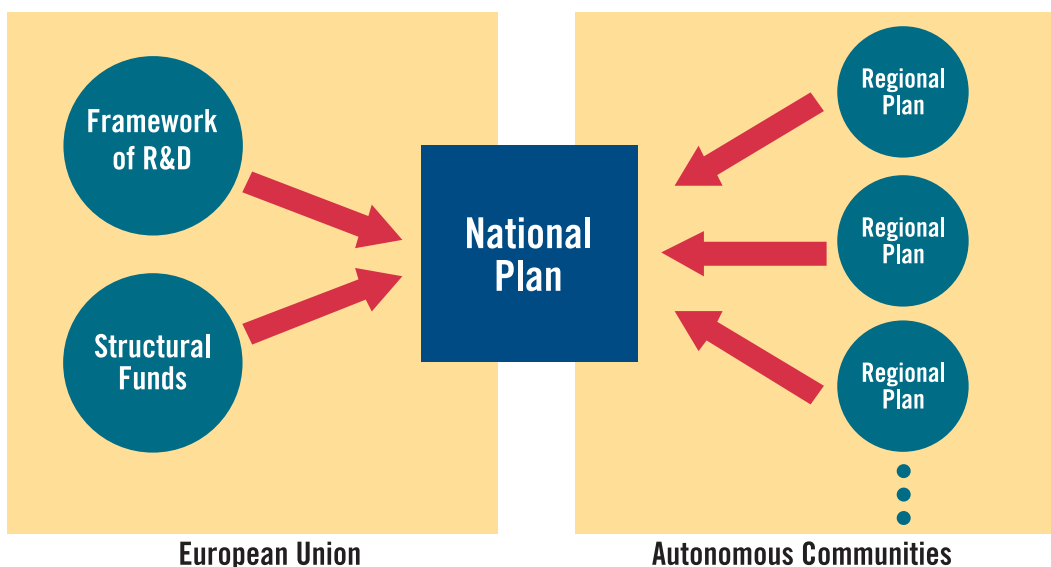


Figure 2
Context of the
National Plan

4.1.1 European context

In the European context, there are two European Union (EU) policies, with which the NP should have a more effective coordination: the R&D&I policy carried out under the R&D Framework Programme (FP) and the regional development policy executed through the Structural Funds.

EU R&D Framework Programme

The EU R&D Framework Programme is the most important instrument of scientific and technological policy which the EU has at its disposal for strengthening the position of Europe in the world context, not only as regards the generation of knowledge but also as regards industrial competitiveness and the quality of life. This programme is a valuable point of reference for the strengthening of the activities of the NP. The importance of the Framework Programme lies not only in the possibility of receiving financing besides that of the NP, though this is important both for the participants and for the evaluation of the global returns Spain obtains, but also in the quality of this returns, that is to say the possibilities that this participation offers for the improvement in the competitiveness of our enterprises and public R&D centres in the international environment.

The aspects to highlight with regard to the relation between the FP and the NP are the following three:

- The role which the FP should play in relation to the objectives of the NP.
- The relation between the priorities established in both programmes.
- The synergy in the of implementation and promotion process of both programmes.

The role the FP should play is not the same for all the areas of the NP. The concentration of R&D efforts that the FP5 has undergone on the basis of the principle of subsidiarity makes the Member States (MS) responsible for undertaking many areas of activity which are either linked to basic research (targeted or otherwise) or that do not need to be undertaken on a European scale; in these cases, the role of the NP is fundamental, because the FP is not going to contribute to the development of those areas

However, in the areas in which the FP is going to develop its activities, the NP has a double role: on the one hand, it must contribute to the strengthening of the public and private R&D groups and of the Spanish enterprises in order to facilitate their participation in the FP, and on the other hand it must complement the range of activities envisaged in the FP with others which will allow an improvement in the results obtained up to now supporting at the same time the position of the actors of the S-T-E system.

The participation in the FP will affect a relatively small number of Spanish R&D groups and enterprises. Because of this, it will be necessary to strengthen the activities in similar themes with priorities that are complementary to those defined in the FP, with the aim of making use of the critical mass of human resources that are needed for the participation and later exploitation of the results.

Another aspect to highlight is the fact that the development of the FP and the NP will coincide in time; this will make it necessary to promote the participation in both programmes, and explaining their complementary nature to the participating actors thus avoiding the problem of lack of interest in participating in the FP.

Structural Funds

The Structural Funds from the EU to facilitate the economic and social development of the regions, constitute an important support mechanism for the financing of R&D&I activities. Their fundamental objective is linked to the improvement of the technological infrastructure in those regions, with special emphasis on the absorptive capacity of the productive sectors in the less favoured regions.

By and large, the new period of the Structural Funds (2000-2006) will give much greater importance to

R&D&I activities by facilitating the existence of multifund operational programmes which will contribute to the fulfilment of the objectives of the NP.

The Structural Funds should facilitate the co-financing of those activities envisaged in the NP which have a greater impact on the economic and social development of the Spanish regions. In this way, the activities to be undertaken with the funds; the European Social Fund (ESF) for objective 3 regions, and the European Regional Development Fund (ERDF) for objective 1 and 2 regions, will include the co-financing of activities related to:

- Training of the human resources.
- Acquisition of scientific-technical infrastructure.
- Creation of centres of competence.
- Co-financing of large and medium-sized scientific-technical facilities.
- R&D, technological innovation and transfer innovation activities as well as dissemination of results in the regional area.
- Interregional co-operation activities.

In spite of the competitive character of the NP, from the co-financing of the activities envisaged in the operational programmes of the Structural Funds by the General State Budgets (GSB), introduces a factor of interterritorial cohesion, which should contribute to the harmonious development of the S-T-E system.

4.1.2 Regional Context

The coexistence of the NP and the regional R&D&I Plans is an opportunity for the cooperation and co-ordination that should be pursued from a perspective of mutual support.

The Autonomous Communities are devoting increasingly greater resources to R&D activities and their coordination with the NP should be based on a co-operation approach, which will be dealt with in more detail later on.

Priority areas of the National Plan

4.2

As regards the priority themes, the NP is structured around a **limited number of priority actions**, where the oriented R&D and technological innovation activities financed from the GSB are included. Non targeted basic research activities for which no specific priorities need to be established are also the subject of the NP.

4.2.1 Scientific-technological areas and sectorial areas

The basic structure of the NP is organised around two different types of activity area: **scientific-technological areas** and **sectorial areas**, for which a set of socio-economic objectives and thematic priorities will be defined.

This scheme is a response to the need to combine support for the generation of new knowledge (scientific and technological), a process which is an essential part of every NP, with that of involving the productive and social sectors more closely in R&D&I activities, as a way to make them participants in the advantages that activities designed to satisfy their precise demands can give them.

With this the NP should help the socio-economic sectors of Spain (both the public and the private

sectors) to participate in a more direct way in R&D&I activities, while these should be conceived from the point of view of the scientific and technological offer as well as from the economic and social demand.

In accordance with these general principles, the concepts of scientific-technological areas and sectorial areas are described below, as well as the list of priority areas identified in each case.

- **Scientific-technological area:** Domain of priority activities linked to the development of knowledge specific to a technology or a scientific discipline.

In the scientific-technological areas, the areas considered are those linked to the development of a technology of a horizontal character, and which allows an increase in knowledge on the same for its application in the short, medium and long terms in different sectors. In this sense, the scientific-technological areas may incorporate targeted basic research (related to technology or knowledge inherent to the area), applied research, industrial technological development, technological innovation and transfer and dissemination of technology activities.

The activities of each scientific-technological area will be developed, fundamentally, from the proposals of the R&D groups, the enterprises and other actors (bottom-up approach) depending on the scientific-technological needs of each area, and in some exceptional cases, through strategic actions with a larger scope and mobilising potential. These activities will generally be linked to an agenda of national priorities defined by the national and international scientific and technological community, and which the NP marks out, adapts and prioritises in accordance with the reality of Spain.

The scientific-technological areas, considered in the NP are:

- Biomedicine
- Biotechnology
- Information and Communication Technologies
- Materials Science
- Chemical Processes and Products
- Industrial Design and Production
- Natural Resources
- Agrofood Resources and Technologies
- Socio-economic Research

- **Sectorial Area:** A set of R&D&I activities geared by the entrepreneurial and social demands and focused on the solution of problems in a specific strategic socio-economic sector.

Generally, these areas, related to sectorial public policies, will involve diverse technologies and areas of knowledge, the interaction of which will be necessary to provide solutions to the problems of the sector with a scientific-technical component.

In the sectorial areas, the activities will preferably be organised around a restricted number of **strategic actions**, with clearly defined objectives and of limited duration, as well as a set of complementary measures (studies, feasibility demonstrations, etc.) which aid the definition and decision making in the diverse sectorial public policies.

The sectorial areas will be defined, therefore, on the basis of the strategic priorities of the different sectorial public policies and will take into account the need to adopt a multidisciplinary and interdisciplinary approach, which will mobilise the greatest possible number of technologies and actors required meeting its objectives. The strategic actions included in these areas should involve in their definition process the different ministerial departments as well as the potential users.

Consequently, the activities of the sectorial areas are not restricted to the application of knowledge generated in the scientific-technological areas, but also include the generation of knowledge and know-how necessary to develop their objectives.

The sectorial areas considered in the NP are:

- Aeronautics
- Food
- Automotive
- Civil Construction and Preservation of Cultural and Historical Heritage
- Defence
- Energy
- Space
- Environment
- Socio Sanitary
- Information Society
- Transport and Land Planning
- Tourism, Leisure and Sport

4.2.2 Basic research

One of the fundamental objectives of the NP, the generation of knowledge, demands special attention being paid to **basic research**. Not only for contributing to solidarity with the international scientific community in the search for the knowledge that is necessary to understand the world around us, man and the leaving creatures and their role in society, but basic research also represents a flow of knowledge, which has implications in the medium and long terms for the improvement of the quality of life of the citizens and the competitiveness of the enterprises. Both of these are objectives of the NP.

With the aim of facilitating a much closer relationship between basic research and applied research, it would be useful for the scientific-technology areas to incorporate **basic research** considered necessary for the development of technologies or associated scientific knowledge. These research activities would be linked to the priorities defined in the corresponding scientific-technological area and would include those themes that are considered to be priorities in the same area. This type of research constitutes **targeted basic research**.

On the other hand, basic research of a general nature not specifically linked to any concrete area and which constitutes **non-targeted basic research** does not require any specific process for determining priorities. This non-targeted basic research is considered in the structure of the NP as an **additional area** and should be strengthened with the appropriate horizontal actions.

Special attention should be paid to some fields of basic research, which are strongly related to diverse technologies and which generally require the existence of complex and costly equipment. In these cases, its activity depends fundamentally on the use of large international research facilities.

Basic non-targeted research comprises:

A generic area for the **General Promotion of Knowledge** which includes all the themes not explicitly contemplated in the scientific-technological and sectorial areas, including the Humanities and the Social Sciences, as well as three specific fields, which individual character is determined by their close connection with certain Spanish and International large facilities. They are:

- Astronomy and Astrophysics
- Particle Physics and Large Accelerators
- Thermonuclear Fusion

The area of General Promotion of Knowledge comprises activities in various scientific fields, as well as in the Humanities and the Social Sciences, while the other three specific areas are linked to large-scale research facilities.

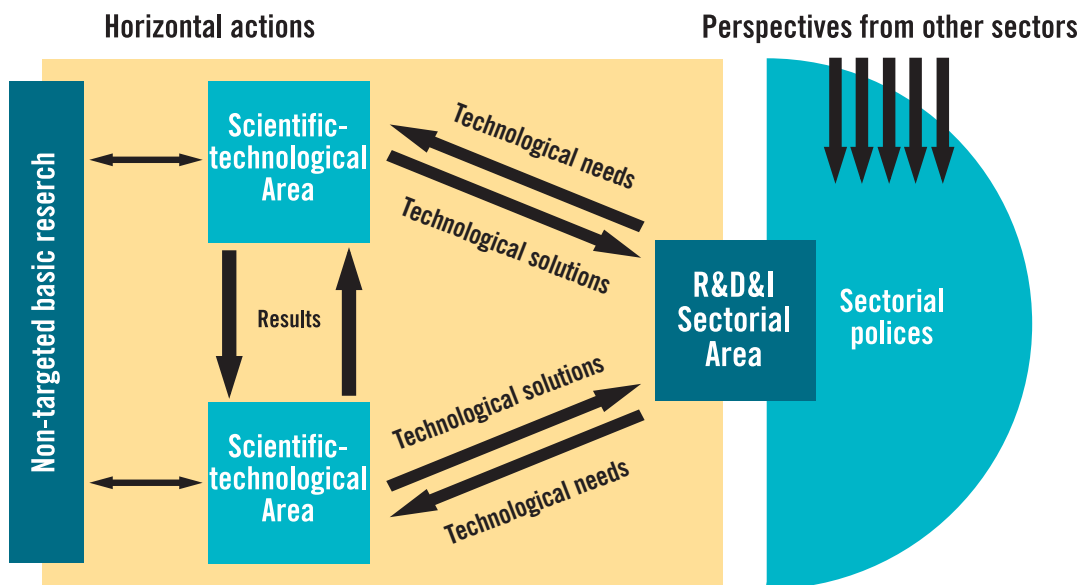
4.2.3. Relationship among the areas of the NP

Figure 3 depicts the interaction between the scientific-technological areas and the sectorial areas, as well as the area of non-targeted basic research and its relationship with the scientific-technological areas. The sectorial areas identify technological needs, which solutions may come from the different scientific-technological areas, most closely related to the first ones.

Figure 3 also shows the existence of horizontal actions applicable to all the areas relevant to the strengthening of the human resources, the international co-operation and the aspects concerned with technological innovation and the diffusion and transfer of results. These aspects will be touched upon later.

In the priority areas of the NP, the R&D&I activities are carried out through **programmes**, allocated with economic resources from the GSB and managed through open calls for proposals and other financial instruments for the promotion of entrepreneurial technological innovation activities.

Figure 3
Relationship
among areas of
the PN



The implementation will be different in the cases of non-targeted basic research, scientific-technological areas and sectorial areas; these differences will find their concrete expression in the several modalities of participation of the actors, who participate in the calls for proposals and in the procedures for the evaluation, selection and financing of the proposals.

In the area of **non-targeted basic research**, the initiative will come from the research groups without the need to be adapted to concrete priorities. An exception will be those priorities resulting from the participation in the R&D programmes of multilateral bodies. The evaluation and selection of the proposals will be based on their quality and their capacity to generate new knowledge.

In the scientific-technological areas it will be up to the R&D groups and the enterprises to determine the contents of the projects that they propose. The evaluation and selection process of the proposals should be undertaken on the basis of their quality (both scientific or technological as well as their adaptation to the priorities established in the calls for proposals) and by their capacity to reinforce the technological level of the R&D groups in public centres, technology centres, or enterprises which will result in the future in an improved international competitiveness for all of them.

In the **sectorial areas** the actors of the S-T-E system will have to propose projects which fall within the prioritised activities included in the work plans defined for each area. These priorities will be preferably grouped around strategic actions identified by the State Administration or the corresponding socio-economic sectors. With this approach, the initiative capacity of the proponents is limited by the need to adapt themselves to the priorities defined for the sectorial area and its strategic actions.

The degree of interaction between the scientific-technological areas and the sectorial areas is not static and the evolution proper of the areas may profoundly modify this relationship. Likewise, the scientific-technological areas are not totally independent one from another, neither are the sectorial areas totally independent from each other. Figure 3 has shown graphically how the sectorial areas may identify a set of technological needs for the scientific-technological areas and how these latter areas may offer concrete technological solutions later on. It is important to note that this interaction does not happen immediately: the strategic actions should be carried out with the technology available or with the technology that can be adapted within the time frame for the activity. However, knowledge of the technological sectorial needs permits the reorientation of the activity in the scientific-technological areas and the dynamic evolution of the priorities of the NP.

4.2.4 Strategic actions

The **strategic actions** are conceived as a cluster of closely co-ordinated R&D&I activities to reach common pre-established targets. The strategic actions therefore constitute the basic instrument for "focusing" the activities of the NP, by concentrating on those problems susceptible of being tackled by R&D projects or of technological innovation activities, and whose results may be obtained during the period covered by the NP. The strategic actions are defined on the basis of the objectives to be reached, the concrete tasks that should be undertaken and the management and, if necessary, the integration procedures to be carried out.

The strategic actions may be included in both the scientific-technological and the sectorial areas and should also serve to foster international co-operation (in relation to the FP) and inter-regional co-operation (in relation to the regional plans). Figure 4 shows the role that the strategic actions may play in the determination of the activities of the areas. In this figure, two types of strategic actions are shown:

- **Multisectorial** strategic actions (technologies or scientific knowledge which affect various sectors).
- **Multitechnological** strategic actions (activity in a sector which requires the utilisation of various technologies).

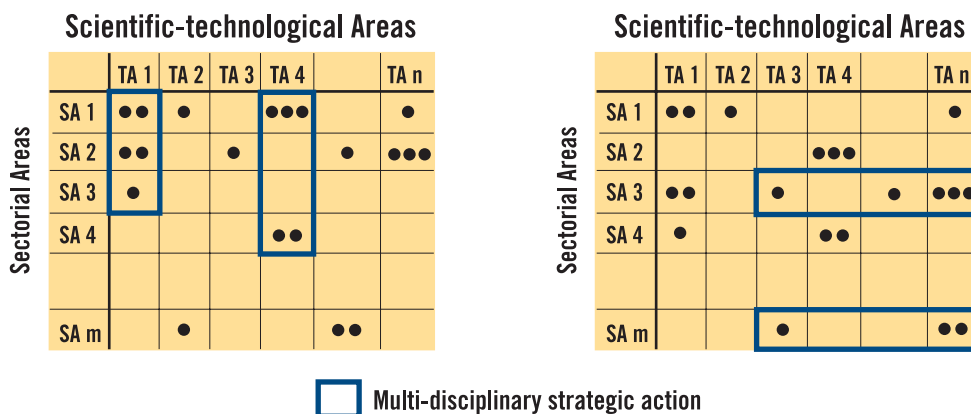
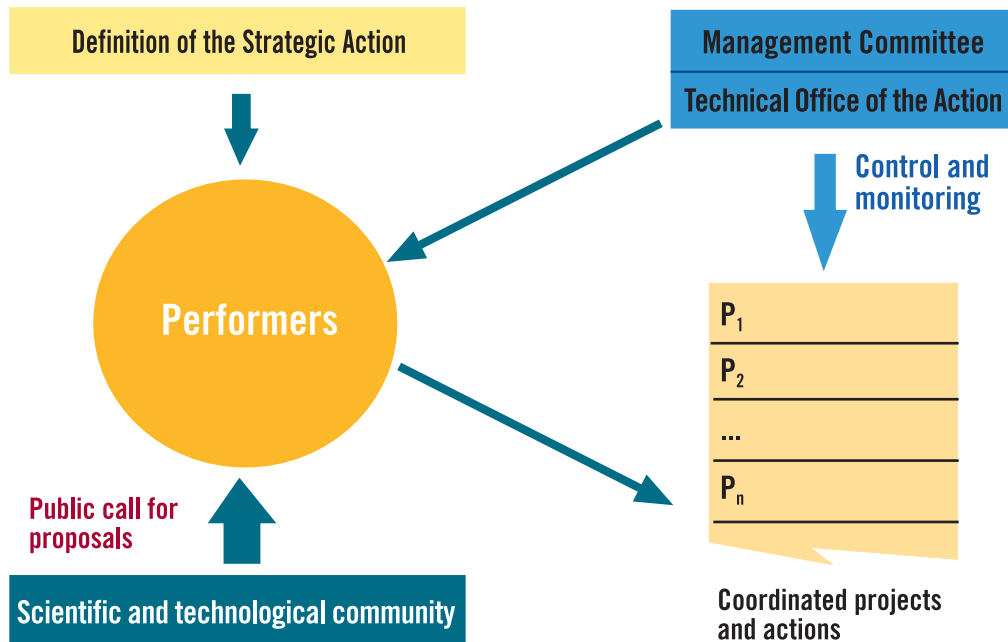


Figure 4. Strategic actions in the scientific-technological and sectorial areas

Figure 5 shows the elements which make up a strategic action. The concepts of the management committee and the technical office of the action will be defined later as management mechanisms to facilitate the fulfilment the objectives of the strategic action. In the above mentioned management committee all those ministerial departments thematically related as well as external experts will participate.

Also in the scientific-technological areas, where necessary, strategic actions may be included. In this case, the rationale will be linked to the necessity to undertake a specific technological development difficult to carry out under the usual formula for R&D projects. In any case, strategic actions will have a reduced weight in the global financing of the corresponding scientific-technological area.

Figure 5.
Structure of the strategic actions



The strategic actions considered in the different priority areas of the NP are:

NON-TARGETED BASIC RESEARCH AREA

Particle Physics and Large Accelerators

- Construction of the Spanish line (SPLINE) in the ESRF (already begun)
- Common elements of the ATLAS and CMS detectors in CERN (already begun)

SCIENTIFIC-TECNOLOGICAL AREAS

Biotechnology

- Genomics and proteomics

Information and Communication Technologies

- Experimental technologies and services for cable networks

Industrial Design and Production

- Microsystems
- High speed mechanisation

Natural resources

- Protected natural areas

Agrofood Resources and Technologies

- Conservation of the genetic resources of agrofood interest
- Agrarian resources and technologies

Socio-economic research

- Knowledge society

SECTORIAL AREAS

Aeronautics

- Advanced structures
- Advanced aeronautic systems
- Air traffic and airport management
- Aerodynamics and propulsion

Food

- New species and technologies in aquaculture
- Quality control and food safety
- Improvements in the quality and competitiveness of wines

Automotive

- Safety systems in vehicles
- Recycling and maintenance of vehicles and components
- Public transport vehicles

Civil Construction and Preservation of Cultural and Historical Heritage

- New technologies and constructive systems
- Maintenance and evaluation of the state of works and buildings
- Preservation of historical buildings and restoration of the heritage

Defence

- Command, control and communication systems
- Armament, ammunition, gun powder and explosives
- Weapons and sensor systems

Energy

- More efficient and less polluting energy systems
- Transport, storage, distribution and more economic and efficient use of energy
- Alternative propulsion systems and new fuels for the transport sector

Space

- Technological developments of subsystems and equipment for small platforms (minisatellites and microsattellites)
- On board instruments and experiments for Earth observation, microgravity and space science.
- Subsystems and pre-competitive applications in telecommunications, navigation and teledetection by satellite.

Environment

- Management technologies and the treatment of refuse
- Instruments, techniques and methods for monitoring environmental variables
- Water treatment and purification

Socio Sanitary

- Ageing
- Health technologies
- Nutrition and health

Information society

- Education and cultural heritage
- Advanced public services
- Electronic commerce services for enterprises
- Telemedicine

Transport and Land Planning

- Improvement in transport safety
- Integrated transport management
- Land planning and sustainable development

Tourism, Leisure and Sport

- Diversification and improvement of the tourist product
- Sports material and equipment
- Increase in quality and safety in tourism and sport

The following table summarises the thematic relationships among the scientific-technological areas and the sectorial areas. In the table, the signs +, ++, +++, are used to represent weak, moderate and strong relationships, respectively.

Table 2.
Relationship among scientific-technological areas and sectorial areas

		SECTORIAL AREAS											
		Aeronautics	Food	Automotive	Civil Construction and Preservation of Cultural Heritage	Defence	Energy	Space	Environment	Information Society	Socio Sanitary	Transport and Land Planning	Tourism, Leisure and Sport
SCIENTIFIC-TECHNOLOGICAL AREAS	Biomedicine		••			•		•	•	••	•••		•
	Biotechnology		••							•			
	Industrial Design and Production	•••		•••	•	•	••	•••	••	••		•	
	Materials Science	••		••	•••	••	••	••			•	•	•
	Chemical Processes and Products	••				••	•••		•••		•	•	
	Natural Resources						•	•	••				
	Agrofood Resources and Technologies		•••						••	•	•		
	Information and Communication Technologies	••		••	•	••	•	•••	•	•••	•	••	•
	Socio-economic Research		•		•		••		•	•••	••	••	••

4.3

Global structure of the National Plan

The concept of the global structure refers to a view of the NP as a whole which allows the use of a framework of reference to understand the way in which the different areas, management instruments, assessment, evaluation and monitoring procedures, and the horizontal actions are all related.

Figure 6 shows the global structure of the NP which includes, besides the area of non-targeted basic research, the scientific-technological areas, the sectorial areas, and the horizontal actions.

As is shown in figure 6, each area may have associated very different volumes of resources, as well as a wider or narrower scope of action. Generally, the sectorial areas will be more focused and will have a smaller scope of activities than the scientific-technological ones. In the same way, the relationship among the scientific-technological areas and the sectorial areas, is shown indicating how

this relationship may be more or less intense. Each one of these areas should have associated the corresponding management bodies; the sectorial areas will have, in every case, a single coordinating body, although there may exist various management bodies associated with the strategic actions, while the scientific-technological areas may have, in general, various management bodies. These aspects will be dealt with in greater detail later on.

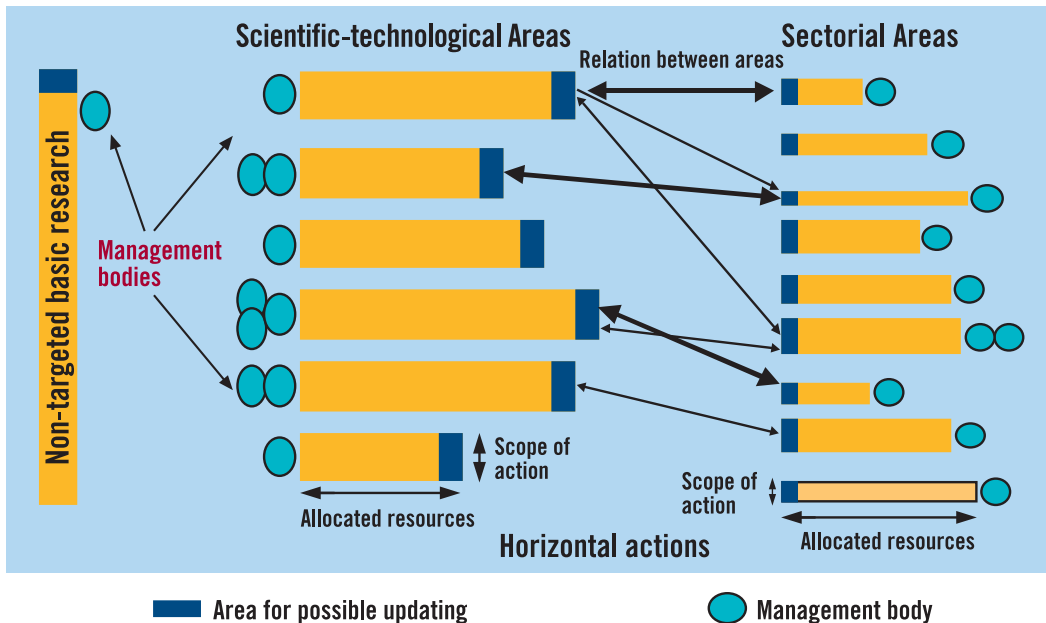


Figure 6.
Global structure
of the NP

4.3.1 Structure of the areas

Figure 7 shows the elements associated with each one of the areas of the NP.

1. Definition of the scientific-technical scope covered by the area

With each one of the areas a differentiated scope activities from the other areas is associated and linked to the strategic actions identified in each case

In the definition of the thematic scope of the areas, international consolidated references are taken into account. This scope will remain unchanged during the period of operation of the NP.

2. Determination of the priorities for the public calls for proposals and actions linked to entrepreneurial technological innovation.

The scientific-technical scope of an area includes a set of **priority lines of R&D** which may be updated annually as part of the process of dynamic evolution of the NP.

In the case of the sectorial areas, the priorities are related to the strategic actions, and these may also be updated annually

In the area of non-targeted basic research, there are not thematic priorities, although sub-programmes based on a grouping of thematically related actions may be established.

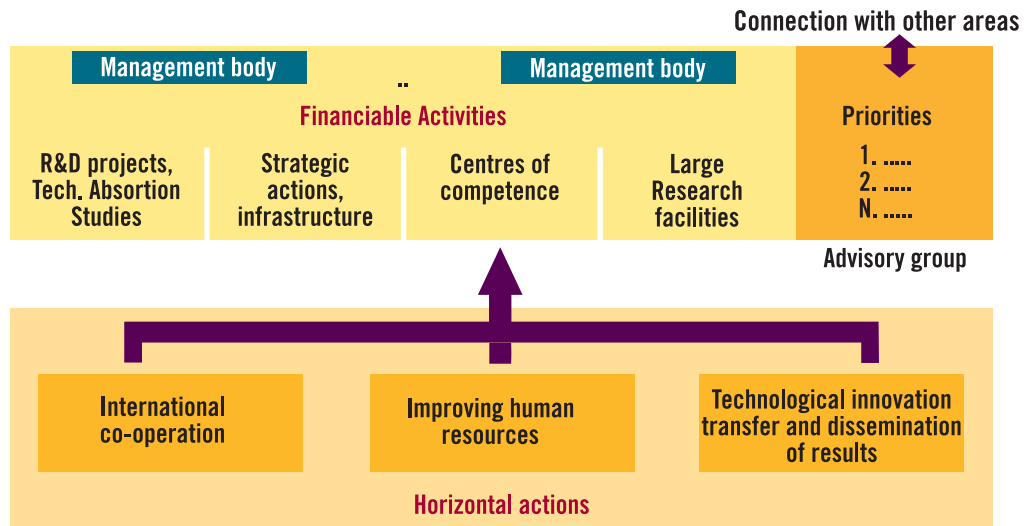
3. Strategy of creation and strengthening of large and medium-size research facilities

Each one of the areas may have associated with it, an action plan for large and medium-size research facilities, which allows:

- To create or to strengthen large or medium-sized research facilities in the technologies relevant to the area;

- To carry out a quality research that without those facilities could not be performed;
 - To facilitate the use of the facilities by different types of users both in the public and private sectors.
- This strategy may be linked, although not necessarily, to the existence of interdisciplinary centres of competence (technology centres or other types), related to the area and provided with the equipment necessary for their functioning.

Figure 7
Global structure of
an area of the NP



4. Specific objectives of the horizontal actions in the area.

Although all the areas have a common strategy in relation to the horizontal actions, in each one of the areas, the concrete activities specific to the nature of the area will be determined. The details of the activities in each one of the horizontal actions will be defined in the annual work programmes.

4.3.2 Horizontal Actions

As has been indicated above, the activities related to each one of the scientific-technological areas and the sectorial areas require a set of **horizontal actions** which allow the development of the basic activities in each area and facilitate the use of the results obtained in these actions by our society.

The horizontal actions have an impact and a scope of activity that exceeds that of a concrete area. Their implementation may, besides, be carried out globally for the NP, with modalities of participation common to all the areas. Notwithstanding, the fulfilment of their objectives cannot be achieved by isolating the planning carried out in each area, but on the contrary by inserting it in the same area.

The horizontal actions cover three fundamental activities:

- **Improving the R&D&I human resources**, with the overall aim of increasing the number of researchers and technologists in Spain and also of making their percentage with respect to the active working population comes closer to our neighbouring countries indicators, while favouring their training and mobility.
- **International cooperation**, with the aim of reinforcing international activities and of co-operating with the international R&D bodies and programmes, thereby facilitating the connection between the activities carried out by those international bodies with the activities carried out in Spain.
- **Technological innovation, transfer and dissemination of the results** of R&D activities to the productive sectors, thus supporting the creation of an innovative entrepreneurial tissue, thus facilitating the access to these results to the Spanish society as a whole, and also encouraging the existence of a supportive environment for technological innovation.

The approach proposed for these horizontal actions reinforces the **integrated model of the NP**, linking the planning of the horizontal actions to the planning of each one of the areas. This approach must be compatible with the existence of a set of common participation modalities and funding instruments, independently of the area considered. The approaches more adequate to each of the horizontal actions are analysed below.

4.3.2.1 Improving the R&D&I human resources

The availability of highly qualified human resources for R&D&I activities is one of the fundamental factors which allows a country to take advantage from the opportunities arising in the world context, especially in a stage of the formation and consolidation of a **knowledge based society**, to which we are approaching at an ever faster pace.

Spain has a higher education system comparable to that of our neighbouring countries. However, the level of education is not sufficient to meet the specialist needs required in certain R&D&I activities, nor it is sufficient to permit the permanent updating of knowledge which constitutes a basic element in this horizontal action. Therefore, a global objective of the NP is to contribute to the competitiveness of the S-T-E system with training activities which will allow an increase in the number of specialised people required for R&D&I activities as well as their mobility.

The activities concerned with human resources should, as a priority, be oriented to improving the groups of excellence, both in the private and the public sectors, and to increase the competitiveness of the technology centres and the Spanish enterprises. It will, therefore, be the basic objective of this horizontal action, the consolidation of the human resources of the R&D groups, the possibility of creating groups in priority areas and the mobility of the personnel between the public and the private sectors.

The NP should contribute to this objective, with five types of activities:

- The training of highly qualified scientific-technical personnel, which contributes to the generation of knowledge, giving priority to their training in the areas of the NP, and based on the medium and long term training needs identified in those areas.
- The availability of scientists and technologists in the priority areas of the NP, that will allow the enterprises, the technology centres and the R&D centres to have sufficient personnel available to undertake the development of advanced products, processes or services, linking their training to the activities of the NP and facilitating long term contracts in the public sector, as the most suitable formula for integrating researchers into the system and encouraging their mobility.
- The possibility of profiting from the existing trained personnel in the public research centres or in international bodies with the aim of creating R&D groups and promoting the development of areas with deficit or strengthening the existing ones. This objective means the gradual adaptation of the training priorities of Spanish researchers in international centres, fitting them to meet the forecast needs in the medium and long term.
- The insertion into Spanish R&D groups of scientists and technologists trained in Spain or in other countries, with the aim of enriching the groups' capacity and of allowing a rapid advance of these groups in the priority areas
- The insertion of qualified personnel in the productive sector, so that they will contribute to raising the technological potential of the Spanish enterprise sector.
- The mobility of trained personnel between the public sector and the private sector or among the public centres, with the aim of contributing to the rapid diffusion of knowledge and of accelerating the process of technological innovation.

4.3.2.2 International Co-operation

The need to insert the R&D activities in the international scenario has already been mentioned when presenting the European context, which affects the process of elaboration of the NP. This process of internationalisation of the R&D activities is not limited exclusively to the European area, but extends to a greater or lesser degree to all countries.

The priorities of Spain in themes of scientific and technological co-operation with other countries do not depend only on criteria of geographical proximity, but also on factors of complementarity and economic and cultural affinity. Spain has well defined priorities in themes of R&D cooperation, which should be strengthened and which are summarised below:

- **Our neighbouring European countries.** This co-operation is carried out fundamentally through the EU R&D Framework Programme, as well as on a bilateral and multilateral basis. This relationship may, in addition, be strengthened through specific activities with some countries to favour the training or the participation in large-scale research facilities.
- **The Latin American countries.** Traditionally linked by cultural and linguistic ties and with a big increase in economic relations in the last few years, the cooperation in R&D with the Latin American countries will continue to be a priority for Spain.
- **The non-European countries of the Mediterranean basin.** It is considered necessary to increase this co-operation, supporting those R&D projects which are carried out with institutions from non-European Mediterranean countries.
- **Other advanced countries.** Fundamentally with the United States and other technologically advanced countries.

The strengthening of international cooperation must be carried out through a set of measures, which reinforce the international dimension of the R&D activities that are planned and especially those in the countries previously mentioned. In accordance with what has been stated above, the horizontal action on international cooperation includes the following measures:

- **Support to the participation in international R&D programmes.** The participation in international science and technology programmes, in particular the EU FP, is considered very positively, being necessary to evaluate the results to adjust, where possible, the level of participation. In any case, concrete measures should be designed to promote the participation of Spanish R&D groups, the technology centres and the enterprises in the programmes where Spanish takes part.
- **Incorporation of Spain to international R&D bodies and programmes.** There are various interesting international activities in which Spain still does not participate. During the development of the NP, a continuous analysis will be done about the convenience of joining some of these, based on the scientific and technological advantages of such a decision and on the economic resources available.
- **International participation in Spanish large-scale research facilities.** The participation of other countries in the Spanish large facilities will be promoted, when its cost and the possibility of profiting from the experience make it advisable.
- **Support for the establishment of agreements between Spanish R&D institutions and institutions from countries of interest to Spain.** Encouragement for the establishment of long term institutional agreements which will facilitate later activities linked to projects, training and mobility of human resources programmes and activities.
- **Contribution to scientific and technological progress in developing countries.** Maintenance and strengthening of the programmes of scientific and technological cooperation with developing countries, thus complementing the Spanish general co-operation with developing countries.

4.3.2.3 Technological innovation, transfer and dissemination of R&D results

One of the general principles of the NP is to contribute to the increase in the competitiveness of the enterprises in order to improve social wellbeing and to create more employment, by means of the application of knowledge and the incorporation of new entrepreneurial ideas to the productive process, that is to say, through technological innovation. In the context of an increasingly globalised economy, the maintenance and increase in competitiveness relies in the ability to learn and even more in the ability to innovate. Technological innovation improves productivity and thus raises the per capita income, basic objective of long term growth. Support for the innovative enterprises will come from activities and instruments designed to improve the entrepreneurial environment and to promote investment by enterprises in intangibles.

This horizontal action has as its basic objective to strengthen the process of technological innovation in the enterprise sectors, by means of a set of activities, which accelerates the process of the incorporation of advanced technologies and the used of the results obtained in the public sector R&D activities. All of this aiming at enriching the innovative entrepreneurial tissue and at increasing the number of new innovative enterprises.

For this a thorough review of the activities in the field of technological innovation must be made. These must be supported by new instruments, clearly different from the traditional ones, with which to try to complete the financial markets for technological innovation and to increase the offer of applied knowledge in the enterprises. These new instruments are the synthesis of support for technological innovation, going much further than mere subsidies. A modern policy of support for technological innovation in Spain demands a different approach, within a clearly European perspective, and with the use of various novel instruments, which reduce as much as possible all and each one of the existing obstacles to technological innovation.

The set of support instruments should be articulated in order to foster a **technological innovation effort** by the enterprises, which is sustained in time and not so much the limited occasional efforts of specific projects. Thus, more demanding effort will be achieved, not only as regards R&D but also as regards infrastructure and other innovative actions. Besides, in order to fulfil the objectives already indicated, it is necessary that the instruments which are put in place have a multiplier effect on the private expenditure in innovation.

The set of instruments that the NP contains aims to resolve a large number of deficiencies which hinder the innovation processes difficult. These deficiencies lie in the lack of adequate training, in the scarce awareness of the public technological offer, in the scarce development of business R&D, in the lack of finance possibilities for the distinct stages of technological innovation and the different types of enterprises, in the lack of inter-enterprise and international co-operation, and in the difficulties of assessing and accessing big and new markets.

Specifically, the NP should contribute to these generic objectives through the following types of activity:

- **Support to innovative enterprises** through horizontal actions and instruments, designed to improve the enterprise environment: improvements in information and advice, co-operation with the enterprises, quality and design, and improvements in the fiscal and financial framework. Besides this, the set of public aid instruments will be reoriented, putting the emphasis on the encouragement of investment by enterprises in intangibles and supporting these enterprises not only with subsidies but also by completing the financial markets.
- Strengthening **the high growth sectors**, which are the determinants of the growth rate, the creation of employment and the generation and diffusion of the new technologies, and orienting to a greater extent the technological infrastructures in order to respond to the problems and challenges of the sectors, and also strengthening the inter-enterprise co-operation and reducing the obstacles to the formation of alliances and cooperation networks.

- Boosting the **creation and development of technology-based enterprises** which encounter serious difficulties in obtaining suitable financing, especially risk capital. The scarcity is especially acute in the launch and start-up phase of the enterprises. In this respect, the aim is to foster the consolidation of risk capital, to improve the mobility of scientific and university personnel to enterprises and to promote young entrepreneurs. This creation of technology-based enterprises, will be carried out stemming from the results of public and private research centres, as well as relying on private initiatives, and should be the most suitable formula to profit from the opportunities which the participants themselves identify.
- **Dissemination** to the Spanish enterprise sectors of the results of R&D activities, as well as of the scientific and technological policy decisions.
- Encouragement of the **protection of the results** obtained in projects and activities financed by the NP or by international programmes in which Spain participates and also the **valorisation** of these results with the aim of making possible their transfer and transformation into commercially viable products, processes or services.
- **Support for the interface units** (linked to the public or the private system) which allow the technological demand of the enterprise sector to be channelled to the public system, and to facilitate the knowledge of the technological offer of the public sector to the Spanish enterprises.

4.3.3 Centres of competence

As a consequence of the scientific and technological evolution in a country, the growth potential in a specific area may require the aid of specialised centres, which have available the critical mass of human and material resources, that is necessary to facilitate an important qualitative advance in that field and serve as a point of reference in the national and/or international context for R&D activities in that area, as well as acting as a support centre for the technological innovation activities in the enterprise sector.

For this reason, the NP includes the possibility of creating centres of competence which will concentrate the experience and knowledge in a specific scientific, technological or sectorial field, as well as the activities designed for the development and reinforcement of the existing centres.

A **centre of competence** is conceived as a stable institution, which may be public, private or mixed (funded publicly and privately), endowed with scientific, technological and administrative autonomy to develop its R&D lines in a scientific-technological or sectorial area. This stable organisation may form part of or be closely connected to other public or private R&D centres, either national or international already in existence or be completely new. The connection with other centres may be achieved by means of association agreements, designed to fit the concrete needs of each case.

In principle, three different types of centres of competence are considered:

CENTRES OF EXCELLENCE IN FIELDS OF EMERGING RESEARCH

In this type of centre of competence the aim is to support the activities of scientific personnel of excellency, by means of a research centre, closely connected to other centres and institutions in the international area. From the organisational point of view, and in particular cases, the creation of mixed centres between Public Research Bodies (PRB) and the universities, the attachment of new centres to a PRB or the centres linked to large scale facilities, which allows the optimisation of the use of specialised or very expensive equipment.

In any case, the effective availability of highly qualified human resources is a basic condition to be taken into account and it will have as much importance as the availability of scientific-technical infrastructure.

TECHNOLOGY CENTRES IN AREAS OF INTEREST FOR THE ENTERPRISE SECTORS

In these cases the creation or strengthening of reference centres in an applied area of interest for certain enterprise sectors is included, with special attention to the interest of SMEs. These centres should respond to the real needs of the corresponding enterprise sectors and should be designed and fitted to satisfy these needs, and so contributing to the development of the sector. The putting into operation of these centres may require the complementary support of the State Administration and the interested Autonomous Communities.

Although the regional interest may facilitate the integration of a new centre in a certain region, its activity should be at the service of the industrial tissue of the whole country. Its location in areas of high innovation intensity, such as technology parks, or its proximity or connection with public R&D centres should be given priority.

For this type of centred, a certain degree of commitment on the part of the enterprise sector as regards the activities to be carried out by them is required, so as to guarantee that their creation responds to initiatives based on real needs.

NETWORK DISTRIBUTED CENTRES

In certain scientific, technological or sectorial fields, the strengthening of R&D&I activities is strongly linked to the coordination among the R&D groups which carry out their work in this area and do not necessarily require the physical creation of a centre. The increasing availability of wide band communication networks and cooperative research tools make this objective easier to attain. The concept of a distributed centre implies the creation of a structure for the coordination of the network of centres. This must be provided with the adequate means not only to facilitate the relations of the centres in the network, but also to deal with external clients (service centres) when the need arises. Moreover, effective measures are included, which encourage the physical mobility of the scientific and technological personnel of the centres, as well as for the carrying out of the execution of joint projects, favouring the existence of complementary scientific-technical equipment in the different centres.

The decision to create a centre of competence may have important economic implications and involve the reassignment of human resources. Therefore it is necessary to take into account the effect that the creation of a centre of competence may have on the existing R&D groups and on their research area, as well as, in the case of technology centres, the real involvement of the entrepreneurial sectors, that can potentially benefit from them. In particular, special attention will be paid to the aspects of integration and cohesion, and to the optimisation of costly or singular equipment.

The financing of these centres may take a variety of formulas, involving the Structural Funds, the funds of the Autonomous Communities, those of the NP, as well as financing from the relevant enterprise sectors.

4.3.4 Large scale scientific-technical research facilities

The large scale scientific-technical research facilities play, in the Spanish S-T-E system, as regards the utilisation and strengthening of the existing ones, as well as the construction of new ones, a quadruple role:

- 1.- **Encouragement for R&D** in a specific area, allowing that, thanks to the existence of a certain large scale research facility, the performance of a type of R&D, which would not be possible without it.

It is evident that having a complex instrument available enables the advancement of the frontiers which is its fundamental objective that justifies the costly investment involved. In this

respect, the potential practical application of the results that are obtained through its use should not constitute its only priority objective.

However, in many cases, a large scale facility may emerge from the process of demonstrating the viability of a new technology or as the infrastructure that is necessary for the development of new products or processes with a medium term utility. In these cases, the practical applicability of the large scale facility is much more evident.

2.- Catalysts of technological development in the areas related to the design and construction of the facilities, employing non-mature techniques but necessary to satisfy the engineering requirements of the equipment it contains.

The construction of a large installation constitutes a technical challenge of the first magnitude, involving the establishment of multidisciplinary work teams in an international context. From this point of view, the technologies linked to the design and construction of large equipment have a great opportunity to make substantial advances, apart from the final utility of the equipment under construction.

3.- Boosters of international co-operation, facilitating the internationalisation of the Spanish R&D groups and the participation of engineering groups in high technology contracts.

It is increasingly difficult to undertake the construction and operation of a large scale research facility by only one country. Its cost and the need to use state of the art (or developed) technologies in various fields and in short periods of time make it essential to consider it as an international project in order to share the investment and the competencies. So, the construction of a large scale facility becomes an instrument for strengthening the relations between enterprises and the internationalisation of them, helping them in their participation as suppliers in international calls for tenders. Finally, large scale facilities also serve to reinforcing bilateral relations in science and technology among countries. In many cases their construction means the creation of consortia with the participation of enterprises and public research centres.

4.- Reinforcers of scientific and technological cohesion, by allowing any Spanish R&D group the access to high quality research facilities and equipment. The possibility of access to a large scale facility (and therefore to the quality research that this implies) by groups belonging to less favoured regions, facilitates contributes to the reduction of their scientific-technical isolation and to the training of their human teams.

Also the decision to build large scale facilities within the framework of the NP influences regional R&D policies, because a large scale facility provides an opportunity for the development of technologies and services in the relevant geographical area and for the emergence of new innovative enterprises around it.

4.4

Dynamic evolution of the National Plan

The NP, in accordance with the evolution of science and technology and the evolution of economic and social demands, should gradually adjust the priorities for its areas through the elaboration of annual **work programmes** which allow for its dynamic updating, while maintaining the basic structure and priorities.

In this respect, besides the general structure of the NP which serves as a reference framework for the 2000-2003 period, annual work programmes will be defined for the period in which the NP is in operation.

Figure 8 shows this process of dynamic updating, in which the planning effort derived from the

preparation of a new NP every four years should overlap with the preparation of the annual work programmes.

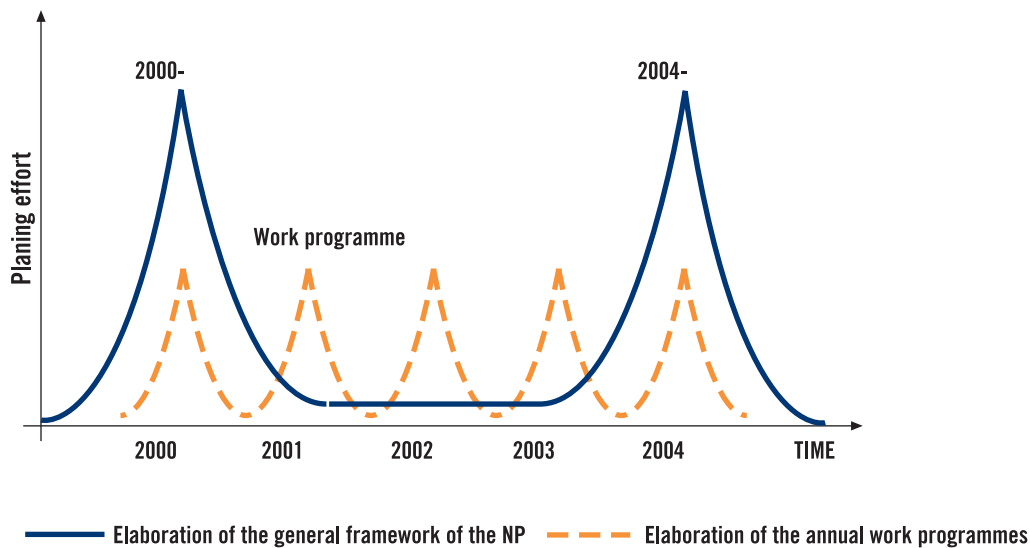


Figure 8.
Pluriannual planning effort

This dynamic updating process should not significantly affect the structure of the NP, but allow small adjustments to the priorities based on the continuous evaluation process implemented. To facilitate technology watch and the carrying out of prospective studies, the creation of a network of **Scientific and Technological Observatories** is envisaged. Figure 9 shows the network scheme. The areas in which more than one observatory participates are co-ordinated to produce their periodical reports.

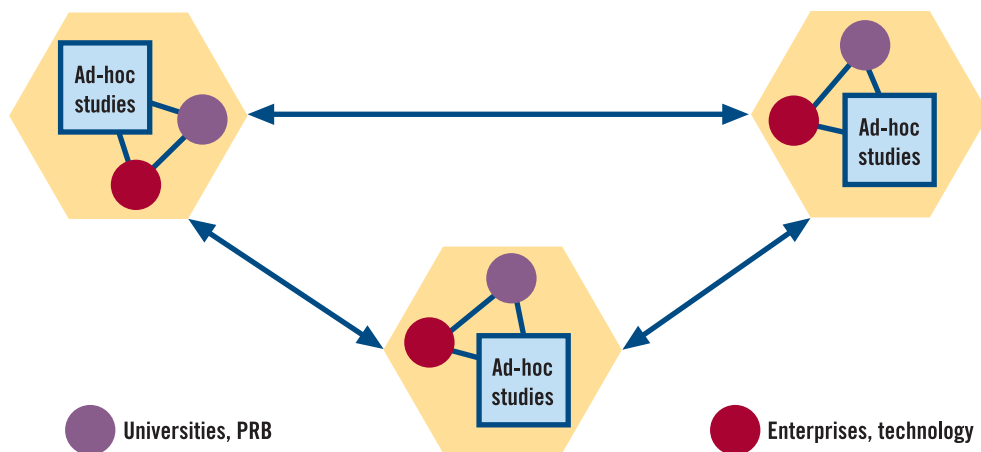


Figure 9.
Network of Scientific and Technological Observatories

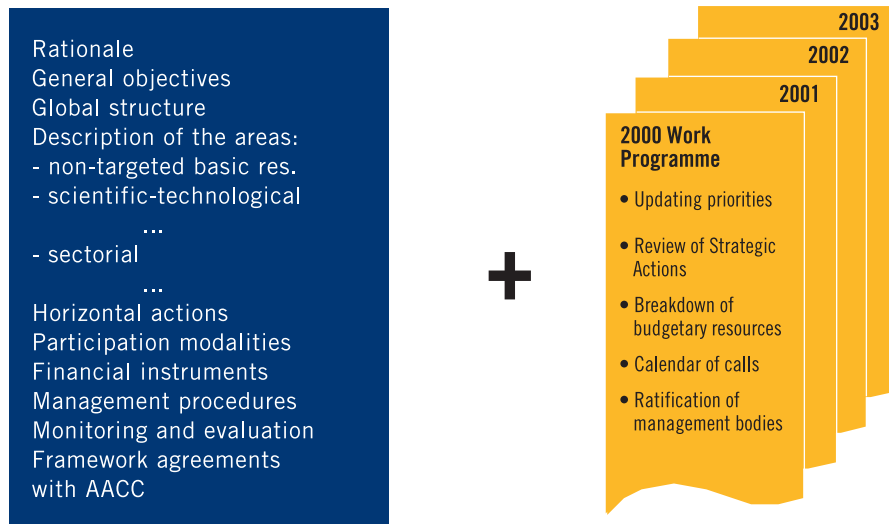
From a more concrete point of view, the separation of the planning process in a general framework and in the annual work programmes allows the division of the aspects that should be undertaken in the general framework and in the work programmes, respectively, as is shown in figure 10.

The **general framework** should contain the following elements:

- The general objectives of the NP.
- The global structure.
- The description of the priority areas together with the basic objectives to be covered in each one of them.

- The description of the horizontal actions.
- The modalities of participation.
- The financial instruments.
- The determination of the management bodies for the areas and the strategic actions.
- The management procedures of the activities, which should be known by the users of the NP.
- The monitoring and evaluation procedures.
- The framework agreements which may be established with the Autonomous Communities for the development of the NP.

Figure 10.
General framework and
work programmes of the NP



The annual **work programmes** should cover the following aspects:

- The updating, if necessary, of the thematic lines associated with the priority areas. This activity will be based on the information derived from the prospective scientific and technological studies, as well as from the monitoring processes of the R&D activities financed in each area.
- Review of the strategic actions, with the possibility of creating new ones and of reorientating or finalising the existing ones. For that, the ministerial departments will establish the strategic needs deemed necessary to support the public sectorial policies.
- Breakdown of the budget by priority areas.
- Ratification of the management bodies for the next year, within the general rules included in the general framework of the NP, as well as the renewal of the advisory groups that may be necessary.
- Calendar for the public calls for proposals, indicating the deadlines for submitting proposals and for their resolution.

Modalities of participation and financial instruments in the National Plan

5

The instrumental area is developed under this heading, where new needs that must be met by the NP are identified in order to offer a richer and more powerful participation framework.

By **modality of participation** it is understood any of the mechanisms that the Spanish legislation provides for the R&D&I performing actors for them to accede, within the framework of the NP, to the financing of its activities from the funds available in the General State Budgets for aids and grants. For each modality of participation specific financial instruments are available.

Performing actors and sources of financing

5.1

By performing actor it is understood any Spanish entity which may legally obtain public funds allocated to R&D&I, and which submits proposals for the financing of its activities and assumes responsibility for their performance.

The performing actors existing in Spain are very varied: universities, public research and experimentation bodies (PRB), technology centres, hospitals, public administration centres with R&D functions (such as, State museums or management centres with R&D capacity), enterprises, foundations (these both as interface actors and also as entities with R&D&I capacity), technology parks, other inter-mediation entities, etc.

These can be classified under the following headings:

- **Public R&D centres:** Public Universities, Public Research Bodies, recognised as such by the Law 13/1986 and, in general, any R&D centre of the public administrations.
- **Non-profit private R&D centres:** Universities and non-profit private entities with proven capacity and activity in R&D. Technology centres whose ownership and management is in the majority controlled by the public administrations are also included.
- **Technology centres:** Innovation and technology centres, recognised and registered as such in accordance with the Royal Decree 2609/1996, of 20 December 1996, and whose ownership or governing body does not have a majority representation of the public administrations.
- **Interface Units:** Non-profit entities with their own legal status, which carry out intermediation tasks among the S-T-E system actors, with the aim of stimulating and fostering the linkages among them.

- **Enterprises:** Bodies or institutions whose basic activity is the mercantile production of goods and services. Public enterprises are also included in this group. A small and medium-size enterprise (PYME) is one which has less than 250 employees, and whose annual turnover does not exceed 40 million euro or whose annual balance-sheet total does not exceed 27 million euro, and in which 25% or more of its capital or voting rights is not owned by one enterprise or jointly by several enterprises, falling outside the definition of SME.

The financing of the actors of the Spanish S-T-E system from the PGE can be classified under 4 different headings:

- **Institutional support** for R&D&I, included in the ordinary budgets of the corresponding institution (public R&D centre, technology centre, interface unit, etc.).
- **Calls for tenders** published by the State Administration for the provision of scientific equipment, technological elements for certain scientific or technological installations, consultancy or support to and promotion for innovation processes.
- **Open calls for proposals or subsidies.** These are based on a competitive basis for the carrying out of R&D&I (projects, the purchasing of scientific and technological material, training of human resources, etc.).
- **Agreements** among the bodies of the State Administration, or between this and public or private bodies, for the undertaking of activities, resulting from their competencies in R&D&I, or for carrying out of studies related to the Spanish S-T-E system.

The first group, **the institutional support**, refers to the use of part of the annual budget of an institution for the undertaking of R&D&I activities determined by the management of the institution, depending on the capacity of their R&D groups and on the role that the institution plays in the S-T-E System. This financing may follow a competitive scheme or, on the contrary, be linked to the priorities directly identified by the management of the institution.

The second group, **calls for tenders of the State Administration**, refers to the financing of the developments or concrete support activities required by a ministerial department to support its own sectorial policy. In very specific cases, there exist activities of this type linked to large-scale research facilities that allow the design of new instruments or pieces of equipment by the chosen institution. The consultancy activities of the General Administration would fall also in this group. In other cases, it may affect the work of demonstration technology or promotion of R&D&I activities.

The third group of activities includes the **open calls for proposals or subsidies**, which the different ministerial departments publish periodically to finance, after the relevant evaluation and selection process of the submitted proposals, the various actors in specific priority areas.

Finally, the last group identified, collaborative agreements between the State Administration and other public or private entities, or among entities of the Administration proper, generally respond to the need of undertaking actions, which commit the parties to contribute specific resources and which reinforce or improve the activities which may have been financed from other sources, or to the need of allowing the carrying out of new ones.

Among the sources of financing, it is important to take into account the **Structural Funds** (ERDF, ESF, EAGGF, IFGF) managed by the State Administration or by the Autonomous Communities and co-financed through the General State Budgets or through the Autonomous Communities respectively, and that result in an increase of the resources available for the performing actors.

Other extra-budgetary sources of financing currently available for the research groups complementary to those covered by the General State Budgets are:

- Financing coming from international R&D programmes or bodies, both the financing associated with the participation of Spain in programmes or bodies which entail monetary contributions (therefore

- of a budgetary nature) and that available from competitive programmes, such as the R&D Framework Programme.
- Credit availability agreements with different financial entities or financial resources resulting from the return of reimbursable credits and which are added up to the resources available for different programmes.
 - Calls for proposals, which certain foundations or large enterprises put at the disposal of Spanish groups, basically from the public sector.

General Objectives

5.2

The modalities of participation should contribute to the fulfilment of the strategic objectives of the NP; besides that, other operational objectives should be taken into account:

1. Strengthening of R&D groups.

The modalities to be designed should allow consolidating the structure of the R&D groups in priority areas as well as supporting the creation of new groups in those areas where an increase of the critical mass of researchers is needed. They should also favour the networking of research groups allowing the establishment of centres of competence and multi-disciplinary activities, as well as the training of researchers in national and foreign centres.

2. Strengthening of innovative enterprises.

The modalities of participation should allow the innovative enterprises, especially the small and medium-size enterprises, to have available the adequate financial instruments to access the necessary technologies to increase their competitiveness.

3. Complementarity among the modalities of participation.

The actors should find among available forms, a panoply of possible actions, each one adapted to the type of institution, thematic area and type of activity, with the possibility of combining various forms in a determined action.

4. Support to the articulation among the R&D&I performing actors

The new forms should strengthen the relationship among the various actors of R&D&I activities, seeking the complementarity among them and promoting actions of "vertical" nature.

5. Efficiency in the allocation of funds

The modalities should be designed with the operational objective of facilitating administrative procedures that can be applied with reduced managerial costs, without compromising the necessary tasks of monitoring and evaluation of the allotted funds.

6. Compatibility among modalities

The different forms should be able to be used together in one determined activity. This complementarity will allow the undertaking of a complex activity from various points of view. One example is the combination of an R&D project with grants of the training and mobility programmes, the financing for a complex piece of equipment or the access to a large-scale research facility.

7. Quality and competitiveness.

The management of the different modalities of participation should, in any case, guarantee that there exist the competitive conditions, which allow the selection of the best proposals, in accordance with the objectives of the NP.

The Law 13/1986 establishes, in its article 5, that the General State Budgets should contain financial and fiscal measures to support and encourage scientific research and technological development activities in enterprises. In effect, one of the objectives of general interest, to which the NP is oriented is, in accordance with article 2 of the above mentioned law is the progress of knowledge and the advance of technological innovation and development.

As a result, one of the objectives of the NP, independently of the modalities of participation which are established, is to provide a set of mutually compatible financial instruments, placed at the disposal of the performing entities with the aim of facilitating their participation and of strengthening the Spanish S-T-E system.

The **financial instruments** have as their objective to cover, with contributions from the public sector, certain costs derived from the participation in the activities of the NP, taking into account the type of actor involved and the technical risk of the corresponding activity.

5.3.1. Types of financial instruments

The financial instruments mentioned below have as their objective to cover the capital and debt needs of the participating entities and to adapt these to the different types of R&D&I activity.

The instruments considered are conceived for their application on the basis of the degree of difficulty or technical risk inherent in each one of the activities, using the subsidies for those activities with a more advanced scientific research or technological development component, or for those cases where a subsidy is necessary to carry out the activity under consideration.

The following instruments are considered:

1. Subsidy

Instrument designed to cover the total or partial costs of the activity under consideration, both as a percentage of the total costs and as marginal costs (additional costs incurred in carrying out the activity).

2. Concurrent subsidy

This procedure is designed to cover partially the costs associated with an R&D project, together with the existence of credits of different types (instruments 3 and 4).

3. Reimbursable credit

This is a credit with low or zero interest, with grace periods and flexible repayment agreements depending on the success of the activity being financed.

4. Credit guarantees

This is a guarantee by the State Administration of the technical risk derived from the concession of a commercial credit by financial institutions for technological innovation activities.

5. Seed capital (Start up funds)

This is to foster the creation of technology-based enterprises by means of a stake in a percentage of the shares for a limited period.

6. Joint investment fund

This is designed to foster the consolidation of technology-based enterprises by means of increments of capital in joint investment funds.

These instruments mentioned above are mutually compatible and they may be jointly applied to various activities in the NP.

5.3.2 Implementation of the financial instruments

The financial instruments mentioned in point 5.3.1 will be associated with the open calls for proposals and subsidies that will be put in place.

The financial instruments should be implemented, with the following general conditions.

- The ministerial departments which manage activities of the NP may use the financial instrument, as the proposed instruments are the instruments of the NP as a whole.
- The possibility of applying them to all the priority areas of the NP.
- The subsidies and the reimbursable credits should be implemented by means of open competitive calls.
- Financial instruments 4 to 6 do not necessarily require the existence of annual open calls, but in any case they should be compatible with the existence of these calls for the activities that require them.
- The combined implementation of the different financial instruments will have to be compatible with maximum limits of State aid established by the European Commission (DG IV).

Figure 11 represents graphically the adequacy of the different financial instruments to the areas of the NP.

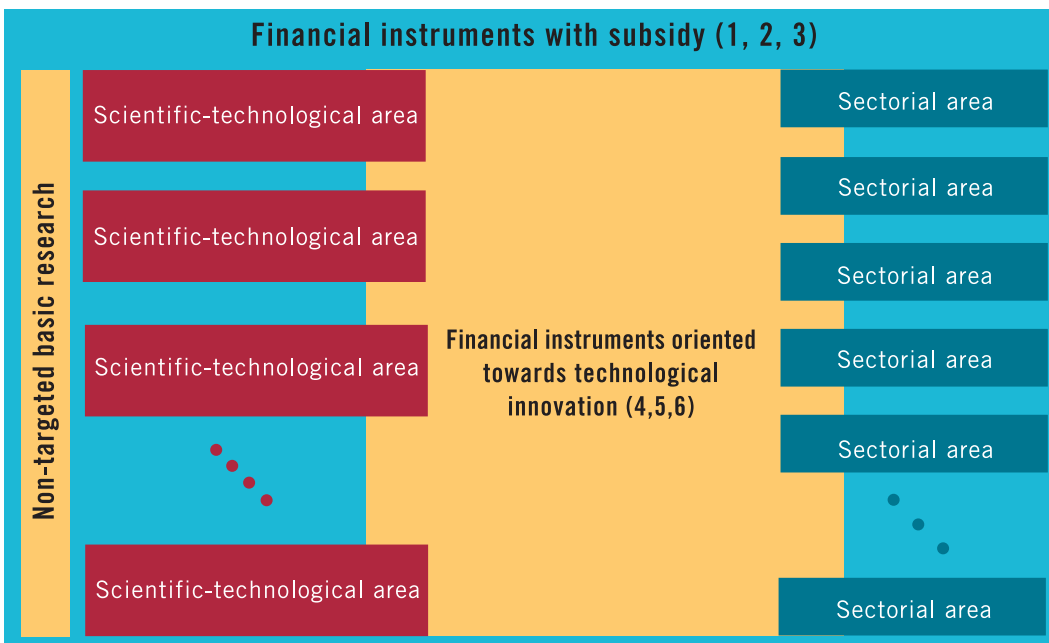


Figure 11.
Use of financial instruments

Figure 11 suggests that the instruments linked to the concession of credits or start-up funds are applied to the scientific and technology areas and mainly to the sectorial ones. Subsidies cover all the activities of the NP.

For basic research (mainly oriented towards the public R&D and innovation system) grants are applied. In the case of enterprise participation, the high technical risk associated with those activities could make it advisable the concession of subsidies that should be complemented in any case with financial contributions from the enterprise.

The implementation of the financial instruments oriented towards technological innovation (4,5,6) implies that there does not exist any "a priori" distribution of the economic resources devoted neither to each instrument, nor to each of the areas. Their application should be linked to the demand made upon them by the enterprises. However, a minimum value will be fixed for each one of the areas.

5.3.3. Fiscal incentives for R&D&I activities

The Law 13/1986 envisages in its article 5, that the General State Budgets will contain financial and fiscal measures, which support and encourage scientific research and technological development in enterprises.

To this effect a series of measures have been designed, which modify the present conditions of the tax headings and the sums that can be deducted from Corporation Tax Law, with the aim of stimulating the undertaking of R&D&I activities by the productive sectors. The Draft Law on Fiscal, Administrative and Social Measures associated with the Draft Law of the General State Budgets for the year 2000 incorporates the following measures:

Improvements in the general regime for R&D

- An increase in the percentages that can be deducted, from 20% to 30%. The deduction allowed for the excess expenses above the average for the previous two financial years is increased from 40% to 50%.
- There is an additional 10% deduction for the costs of research personnel and for projects contracted with Universities, Public Research Bodies and Technology Centres. The resulting percentages are 40% and 60% respectively.
- There is an increase in the joint limit of deductions to 45% of the quota in the financial year, when the deduction for R&D exceeds 10% of the said quota.
- There is a wider understanding of the concept of R&D, which allows deductions for advanced software, prototype development and demonstration models.
- In order to facilitate the application of incentives and to provide them with legal security, the possibility of proposing an application for a binding ruling and of reaching prior agreements with the Ministry of Economic and Finance are included.

New incentives for technological innovation

For the first time, deductions for expenditure on technological innovation are included under the following headings and with the same joint limit.

- A deduction of 15% for technological innovation projects in collaboration with Universities, Public Research Bodies and Technology Centres.
- A deduction of 10% for the costs for industrial design and engineering for production processes (including the conception and elaboration of plans, drawings, support techniques to define the descriptive elements, technical specifications and the functional characteristics necessary for the manufacture, testing, installation, and utilisation of a product).
- Deduction of 10% for the acquisition of advanced technology (patents, licences, know-how and designs) which allow the enterprise to obtain a special competitive advantage.
- Deduction of 10% for the expenses incurred in the certification of quality regulations.

The simultaneous coming into effect of the NP and the above-mentioned measures provides an especially favourable environment for R&D&I in enterprises and should give a decisive boost to their investment.

Modalities of participation

5.4

The modalities of participation envisaged in the NP can be classified in five principal categories.

5.4.1 Improving human resources

In this group the modalities of participation related to the training, mobility and contracting of personnel for R&D&I activities are included. The aim of this is to increase the research and technological capacity of R&D groups, both in the public and the private sector, and thus facilitating:

- The existence of qualified personnel at all levels, adapted to the identified needs of the priority areas of the NP.
- The mobility of personnel between different centres, both public and private, which facilitates the interaction among all of them, by means of networks, with special attention being paid to international relationships.
- The increase in the number of consolidated personnel in the groups of the public R&D sector, which allows a gradual increase in the availability of personnel in the areas that so require through a contracting formula that complements the recruitment mechanism for civil service posts.

The measures related to the training of researchers include provisions for the following modalities:

- Pre-doctoral fellowships aimed at young graduates, engineers or architects, who wish to do a PhD thesis, during a maximum period of four years in public or private Spanish R&D centres. In exceptional circumstances, the fellowships could be carried out abroad.
- Fellowships for the training of technologists. These are understood as those graduates, who specialise in a certain subject, for a maximum period of three years, without the need to do a doctoral thesis.
- Post-doctoral fellowships, aimed at completing advanced training, preferably abroad, for recently qualified post-doctoral personnel, for a maximum period of two years.

The grants for mobility are aimed at promoting the exchange of researchers, with the objective of establishing collaborations and of strengthening research groups. In this respect the following modalities are considered:

- Stays of researchers (doctors and technologists) from public or private Spanish R&D centres in other centres or enterprises in Spain or abroad, in order to improve their knowledge in a certain subject related to the priority areas of the NP.
- Stays of researchers linked to foreign centres of recognised prestige, who wish to collaborate with Spanish R&D groups, for a temporary period.
- Short stays by researchers from public R&D centres and universities in enterprises, preferably small and medium-sized ones, to assist them in their R&D&I activities. The idea is to aid the transfer of knowledge and results from the public sector to the enterprise sector, as well as improving the knowledge of the public sector researchers about the technological needs of the enterprises.

Under the heading of recruitment of personnel for R&D&I tasks, five different types of grant are envisaged. These will always require the co-financing, with a greater or lesser sum, depending on each case, for the beneficiary institution.

- The incorporation of doctors in enterprises and technology centres for the development of R&D&I activities, with the aim of improving their technological capacity. The grant will last a maximum of three years.
- The incorporation of technologists in small and medium-sized enterprises also for a maximum of three years, with the aim of promoting innovation activities in the small and medium-size

enterprises and thus helping them to create new business lines and to get greater access to new markets.

- The incorporation of technical personnel in large and medium-sized Spanish research facilities, during a maximum period of two years, with the aim of improving the capacity of the said facilities for providing services.
- The contracting of young doctors in public R&D centres, with the aim of reinforcing the supply of personnel and the activities of the R&D groups. The contracts, with a maximum duration of five years, will be linked to a concrete activity.
- The contracting of doctors with more than ten years of professional experience in public R&D centres, in order to make it possible to create new R&D groups or to initiate new lines of research. The contracts may last for a period of five years, and may be renewable for a further similar period.

5.4.2 R&D Projects

The undertaking of R&D projects is the fundamental mechanism for developing R&D activities with the objective of increasing scientific and technological knowledge, for its application in the short, medium and long terms, with the ultimate aim of improving the quality of life of the citizens and the competitiveness of the enterprises. The criteria for determining the different modalities in this section should be:

- To try to have the minimum number of modalities, but with the needed scope to allow them to encompass all the different types of activities to be undertaken.
- To provide the foreseen modalities with sufficient flexibility to be able to serve the different types of performing actors, distinguishing when necessary, the types and amounts of financing as well as the applicable evaluation criteria.

In this group, the financing of the following modalities of projects is included:

- Scientific research projects in the area of non-targeted basic research, lasting up to three years, developed by public R&D centre groups, by non-profit private R&D centres and by technology centres, and in which enterprises may participate as institutions having an interest in the results of the projects.
- R&D projects (including targeted basic research and pre-normative R&D) linked to the scientific-technological areas and to the sectorial areas, and which are carried out independently by research groups of public R&D centres, non-profit private R&D centres, technology centres or enterprises.
- Co-operative R&D projects, a new modality designed to promote the co-operation among the different actors of the S-T-E System for the development of R&D activities related to the scientific-technological areas and to the sectorial areas. These are projects that last several years, and that carried out by consortia made up of different kinds of performing actors, and in which an enterprise may sub-contract R&D tasks to a public centre or a technology centre.
- Financing of consolidated groups in public centres and technology centres, for periods of up to five years, and with a prior determination of the expected objectives, which will be fixed in each case in accordance with the type of group and the proposed work plan. The idea is that these consolidated groups, with the support and the involvement of the institution to which they belong, direct their activity to the priority areas of the NP, thereby contributing to strengthening those areas. In this modality enterprises may also participate as institutions interested in the results of the said activities.

The level of financing of the projects will be different, depending on the type of performing actor and the type of costs (marginal or total) to be subsidised. In general, in the case of public centres or non-profit private centres, the marginal costs associated with the project will be subsidised. In the case of technology centres and enterprises, a percentage of the total foreseen costs will be subsidised. The

percentage of the subsidy may increase in the case of small and medium-sized enterprises or consortia, which include more than one enterprise. The various financial instruments foreseen in the NP may be of application to the enterprises, taking into account that by no means the limits established by the European Union regulation for public aids may be exceeded.

In any case, in the financing of the projects the joint participation of various actors will be considered a positive criterion. This will be especially so, the greater the involvement and the diversity of these actors.

5.4.3 Support to technological innovation

Under this heading, the actions trying to apply the results generated by other R&D activities to the Spanish enterprise sectors are included. The objectives to be pursued are:

- To bring technology closer to the development of products, processes and services, in a phase prior to their engineering and commercialisation.
- To strengthen the existing interface units, between the public and the enterprise sectors.
- To involve more closely the Spanish enterprises, with special emphasis in the small and medium-sized enterprises (SME) in innovative activities.

In this group, the activities aiming at the commercialisation or the promotion of the results of their own innovation are not considered. Neither are those activities aiming at introducing quality systems.

The planned activities include the following actions:

- Technological innovation actions, whose objective is to foster the incorporation into enterprises and technology centres of already existing technologies which will give a competitive advantage to a specific enterprise sector or to a specific geographical zone.
- Technological demonstration actions, designed to assess the viability of incipient technologies or of new technological solutions which may be commercialised in the medium or long term.
- Fostering the creation of new technology-based enterprises, making use of the results of the R&D activities of the public research centres, by means of the partial subsidising of the enterprise business plan.
- Launching of technology-based enterprises, through the application of start-up funds, with the objective of supporting the creation of new enterprises which may arise from the initiative of other enterprises or of people who exploit their technical knowledge.
- Support for the creation and functioning of interface units, which foster the transfer of scientific and technological knowledge among the actors of the S-T-E System.
- Exploitation by the productive sectors of the knowledge and results of R&D activities of public and technology centres.

5.4.4 Scientific and technical infrastructure

The existence of complex scientific and technical equipment is, in many areas, a basic requirement for developing a competitive R&D activity. In this sense, the general objectives pursued are:

- To optimise the use of the available equipment, by making easier its operation and maintenance.
- To facilitate the use of the said equipment by the Spanish scientific and technological community.
- To make sure the involvement of the institutions where the equipment is located so as to guarantee its stable use in the medium and long terms.

In consequence, the following modalities are envisaged:

- Small scientific-technical equipment (in general with a cost of 10 to 50 million peseta) for public R&D centres.

- The acquisition, improvement and renovation of medium-sized scientific-technical facilities (in general with a cost of 50 to 500 million peseta) in public R&D centres and technology centres.
- Aid for the establishment of centres of competence or for a substantial change of activities in the existing ones, within the framework of the priority areas of the NP, taking into account the economic contribution made by other entities (enterprise sectors, Autonomous Communities, etc.).
- Aid to improve the functioning and exploitation of the Spanish large-scale research facilities in accordance with the criteria established by the Spanish Advisory Committee for Large-scale Research Facilities, and ensuring the existence of regulated mechanisms for guaranteeing the access for the whole Spanish scientific and technological community.

In all cases, the aid for scientific and technical equipment will require the economic contribution of the beneficiary entities.

5.4.5 Special Actions

This heading includes other forms of support for the activities of the NP and, in general, of the S-T-E System, which do not fit in the previous groups and that refer to specific actions such as the following:

- Aids to promote the participation of Spanish groups in international scientific co-operation programmes, with special reference to the EU R&D Framework Programme.
- Diffusion of results, in order to inform society and the enterprise sector of the Spanish capability in research, in generation of technology and in the solution to daily problems, as well as the scientific and technological popularisation aimed at ample strata of Spanish society.
- Support to the thematic networks in which various actors of the S-T-E system participate, with the aim of promoting co-operation among actors and facilitating the exchange and transfer of knowledge.
- Aids to the organisation of conferences, seminars and one-day events in Spain, especially those with an international character.
- Studies related to the S-T-E System, which allow a deeper understanding and analysis of the different aspects of this system.
- Support to the international promotion and transfer of technology, with the aim of internationalising the Spanish technology by means of its promotion and commercialisation abroad.

5.5

Relationship between financial instruments and modalities of participation

Although conceptually the financial instruments are applicable to all the activities in the NP, their applicability is linked to those actions that facilitate the achievement of the objectives of the NP and which also satisfy the legal conditions for their implementation.

Table 3 summarises the relationship between the financial instruments and the modalities of participation.

Figure 12 represents the application of those instruments as a means of supporting the articulation of the Spanish S-T-E System, indicating the applicability of the instruments to the different types of performing actors. For reasons of simplicity, only three types of performing actors are considered: public R&D centres, technology centres and enterprises.

	HUMAN RESOURCES	EQUIPMENT	R&D AND INNOVATION PROJECTS	INNOVATION AND TECHNOLOGY TRANSFER	SPECIAL ACTIONS
1 Subsidy	•	•	•	•	•
2 Concurrent Subsidy	•	•	•	•	
3 Reimbursable Credit		•	•	•	
4 Credit guarantees				•	
5 Seed capital				•	
6 Joint investment Fund				•	

Table 3.
Relationship between financial instruments and modalities of participation.

As can be observed in Figure 12,

- the public R&D centres and the technology centres can finance their activities by means of subsidies, concurrent subsidies and reimbursable credits;
- the enterprises can finance their activities using all the financial instruments mentioned.

The interactions among the different actors of the system are described in two distinct sets. The first part (1) is applicable to the public centres or the technology centres, and the second part (1,2,3,4) is applicable to the enterprises. Thus, between the enterprises and the public centres the modalities of participation are supported economically in a different way depending on the actor involved; while the public centres receive subsidies, the enterprises can receive subsidies, credits or combinations of credits and subsidies.

With a view of facilitating the articulation of the Spanish S-T-E System, it is deemed convenient that the degree of aid (for example, the percentages of the costs of the activities covered by the aid) should be higher when it involves different actors. This "articulation bonus" should be applied in the case of activities simultaneously involving at least two different types of entities.

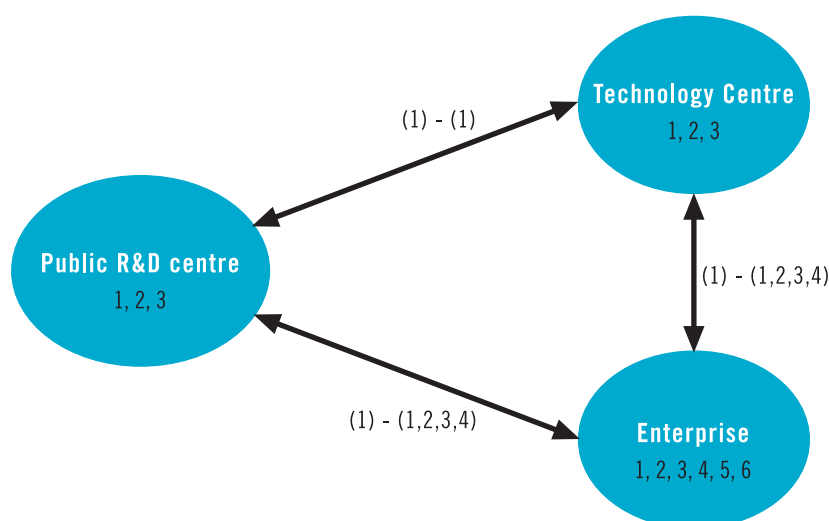


Figure 12.
Application of financial and fiscal instruments

Co-operation with the Autonomous Communities

6

One of the objectives of the NP, within the general objective of promotion and general co-ordination of scientific and technical research that article 149.1.5 of the Spanish Constitution entrusts to the State, is to make progress in the identification of concrete procedures for co-operation with the Autonomous Communities, within the framework offered by the Law 13/1986, which created the General Council for Science and Technology to promote general co-ordination of R&D. It appears among the functions of the General Council that of proposing research programmes and research projects of the Autonomous Communities and of promoting joint activities among the Autonomous Communities, or between the latter and the State Administration, for the development and carrying out of research programmes. In this way, the aim is that the regional context, previously referred to in this document, should have an explicit interaction mechanism in the structure of the NP, both in the determination of priorities and during the carrying out of the activities.

The general mechanism for co-operation will be the establishment of **framework agreements** with the Autonomous Communities during the period of operation of the NP, with the following objectives:

- To provide the Spanish technological and scientific community with a convergent framework for activities between the State Administration and the Autonomous Communities, which boosts the capacity of the R&D groups, both in the public and the private sectors, and which avoids the duplication of efforts and economic resources.
- To intensify the activities (projects, infrastructure, etc.) which are financed through the NP, contributing complementary financing in some thematic areas of common interest.
- To complement the activities which each party carries out in relation to the horizontal actions of the NP, with the aim of strengthening these in the regional context.
- To support the co-operation among the Autonomous Communities within the framework of the NP, favouring the mutual interaction among the regional plans and of the regional plans with the NP, and establishing the mechanisms for the exchange of information that may be necessary.

The establishment of a framework agreement between an Autonomous Community and the State Administration should abide by the following principles:

- **The voluntary nature of the agreements signed.** Each Autonomous Community should decide whether it wishes or not to establish an agreement with the State Administration.
- **The bilateral nature of the negotiation.** Given the different interests in science and technology among the Autonomous Communities, the content of each framework agreement will be negotiated by the State Administration with each one of the Autonomous Communities, and within the set of themes which may be the object of negotiation between the parties.
- **The co-financing of the actions.** The existence of a framework agreement with any of the

Autonomous Communities will imply the allocation of economic resources by both parties for the carrying out of the activities included in the agreement.

- **National scope.** The concurrence for the participation in the activities agreed with any of the Autonomous Communities and which are undertaken in that Community will have to be open in equality of conditions to all Spanish R&D groups or enterprises, independently of their geographical location.
- **Stability of the agreements.** The agreements will have to cover, in principle, the whole period of operation of the NP, independently of its potential thematic updating. In any case, a mechanism for the monitoring and evaluation of the agreements should be established.
- **Transparency in the agreements.** The proposal for the agreements reached between the State Administration and any of the Autonomous Communities will have to be approved by the General Council for Science and Technology before its inclusion in the NP.

These framework agreements should find their concrete expression in packages of activities, which may be modified annually, by agreement between the parties, in line with the concept of the "dynamic evolution of the NP".

This process must be based on the exchange of information about the National and the Regional S-T-E Systems. Specifically the exchange of information between the State Administration and the Autonomous Communities, and among the Autonomous Communities themselves, will refer at least to:

- The priorities and the performance of the NP in the different Autonomous Communities, for the knowledge and evaluation of the mechanisms employed and the degree to which the objectives have been reached.
- The priorities and the performance of the Regional R&D Plans, for the knowledge and evaluation of the mechanisms employed and the degree to which the objectives have been reached.
- The concession of subsidies to the actors of the S-T-E System with the objective of avoiding duplication.
- The budget forecasts in the NP and in the Regional R&D Plans.

For the establishment of the action packages, the State Administration will analyse with each one of the Autonomous Communities the concrete aspects that can be agreed within the set of themes which may potentially be the object of co-operation and which are indicated below:

- The creation or significant reorientation of centres of competence (centres of excellence, technology centres or network distributed centres).
- Support to the creation of scientific and technological infrastructure (medium-sized facilities, support to small scale infrastructure for R&D public groups, technology centres, etc).
- Participation in the financing of the construction and operation of large-scale scientific-technical facilities located in a determined Autonomous Community.
- Participation in the proposal, financing and execution of strategic actions within a specific thematic area.
- Co-financing of open calls related to the horizontal actions of the NP. As an example of the actions which could be agreed with regard to the said horizontal actions, the following may be cited:
 - Creation of technology-based enterprises, stemming from technology centres, or public research centres, located in an Autonomous Community.
 - Training of human resources (mobility, technologists, doctors in enterprises, incorporation contracts, etc.).
 - Support to the promotion and diffusion of results, both of the national and international R&D plans, in the region under consideration.
- Other activities that may be agreed by the General Council for Science and Technology for the whole of the Autonomous Communities and which fall within the framework of the activities and instruments defined for the NP.

The financing necessary for these activities may be established using budgetary funds of the Autonomous Communities and the State Administration as well as Structural Funds, either from the operational programmes of the State Administration or of the Autonomous Communities.

Management of the National Plan

7

Monitoring and evaluation

7.1

The **monitoring** of the R&D&I activities financed by the NP has for its objective the obtaining of the necessary data to be able to undertake its technical, administrative and economic management. The design of the corresponding procedures is based on criteria of **rationality**, in order to simplify the mechanisms for the reception and treatment of the requests, the transfer of assigned funds and the technical and economic control of the financed activities, on **quality** in the instruments for the management of the NP, and flexibility in accordance with the needs of the different types of performing actors.

The **technical monitoring** aims to have a clear view of the results of the financed activities. The mechanisms should be based on the presentation of the results, by the performing actors before groups of experts and managers, and when it is appropriate before those people responsible for other related activities. In any case, the necessary conditions of confidentiality for industrial projects will be assured.

For each strategic action a Monitoring Committee will be established to oversee the adequate coordination between the strategic action and the other activities in the area or in the related priority areas.

With respect to the **administrative monitoring**, the management bodies will carry out this function through audits or periodic checks, which will allow for the verification of the expenses incurred in each activity and to assess the adequacy to the planned tasks.

The **financial instruments** of the NP assure the **neutrality of the management** with respect to the maximum sums of the aids and subsidies so that these sums do not depend on the management body, but on each type of activity and of actor which receives them.

The fulfilment of the objectives and priorities at all levels of the NP should be controlled by means of the performance of the following types of evaluation of the financed actions:

1. **Ex-ante** evaluation for the selection of the proposals in the public calls for proposals.
This type of evaluation is performed in two phases, one external and the other internal to the body that manages the call. The external phase is based, for basic or applied projects, on peer evaluation, which is performed by the National Agency for Evaluation and Forecasting (ANEP),

which should be strengthened. For the technological innovation projects, panels organised by the Centre for Industrial Technological Development (CDTI) will carry out the evaluation. The internal phase is the responsibility of each management body which taking into account the evaluations of the previous phase will apply its own evaluation mechanisms leading to the definitive selection of the proposals to be financed.

In the case of strategic actions, which for their inherent characteristics demand it, a previous qualification phase of the performing agents, who respond to the calls, may be required.

2. **Continuous** evaluation of the performance of the NP.

The objective of this type of evaluation is to measure in a continuous dynamic form, throughout the period of time of the operation of the NP, the aspects related to the fulfilment of the objectives and priorities established in each of the priority areas. The collection of the data necessary for the continuous evaluation of the execution of the NP should be integrated with the regular tasks of monitoring the activities financed by the corresponding management bodies, thus avoiding overloading the performing actors and guaranteeing their responses. In this way, the data to be used comes from the proposals for the open calls themselves, from the selection processes, and from the intermediate and final monitoring reports. These last reports allow us to consider progressively the aspects of **ex-post** evaluation on the results obtained in each project or activity. The aggregation of all this data in appropriate indicators will allow the carrying out of the evaluations of the areas and of the NP as a whole.

In order for this integration between the activities of monitoring and continuous evaluation continues to be effectively possible, there will be an adequate co-ordination throughout the whole NP the contents of the information required, taking into account the different participation modalities and the different financial instruments involved.

3. **Annual strategic** evaluation of the priority areas.

This type of evaluation is based on the annual integration of the results of the continuous evaluation of the process of execution of the NP, with the annual reports of the Scientific and Technological Observatories, and with the recommendations of the corresponding Advisory Groups for each area. The results of this evaluation will supply elements for the decision-making in the elaboration of the **annual work programmes** of the NP.

All the information accumulated by the evaluation activities of the NP will be recorded in a **data base** in order to facilitate in the future the carrying out, observing all the legal requirements of confidentiality and data protection, of analyses and specific studies of interest for the aims of scientific and technological policy.

The need for monitoring and evaluation within the NP requires an increase in the number of managers and an improvement in their training in the bodies responsible for the calls for proposals, with the aim of providing them with the adequate technical capacity to facilitate the monitoring and evaluation of the activities, even though part of these tasks could be undertaken with the aid of people coming from the scientific and technological communities.

Moreover, it will be necessary to guarantee the availability of suitable administrative structures to manage the activities of the NP with the necessary flexibility and speed, without losing rigour in the economic and technical control of these activities.

7.2

External advisory

With the objective of facilitating the strategic evolution of each area, an external advisory structure has been created, formed by advisory groups independent of the administration, for the following twin objectives:

- To analyse the global results as they are obtained in the scientific-technological and sectorial areas during the carrying out of the NP.
- To propose modifications to the objectives and priorities of the areas.

Figure 13 represents the management and advisory structure envisaged for the NP.

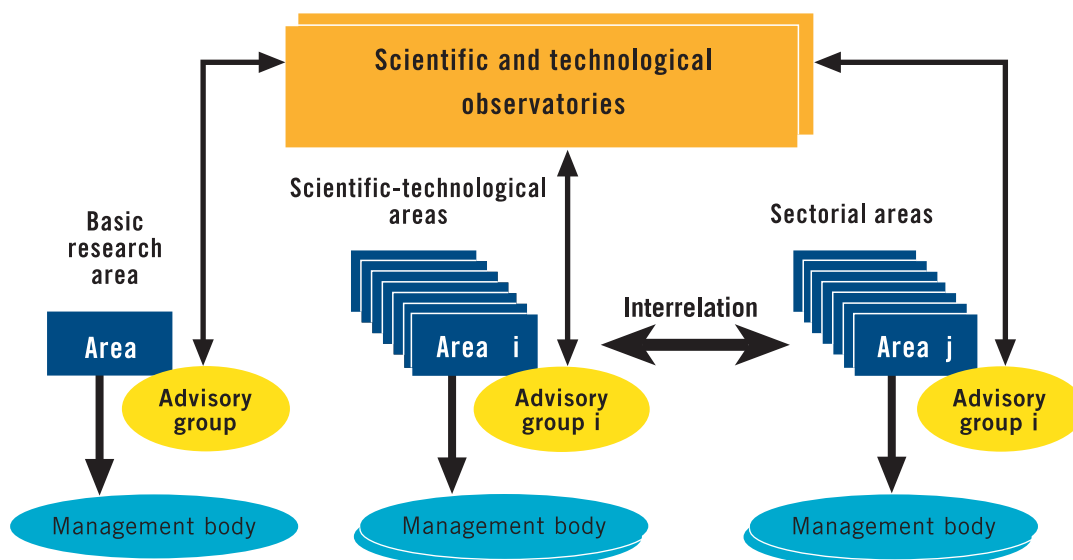


Figure 13.
Management and advisory structure of the NP

The advisory structure is made up of the following components:

Advisory councils of a general character at present in existence:

- General Council for Science and Technology (created by the Law 13/1986)
- Advisory Council for Science and Technology (created by the Law 13/1986)

Existing specialist advisory committees:

- Advisory Group on Information Industries (created by MINER)
- Advisory Committee for Large-scale Research Facilities (created by CICYT)
- Spanish Polar Committee (created by CICYT)
- Co-ordinating Commission for Agrarian Research INIA - Autonomous Communities

Advisory groups proposed for the NP:

With the aim of facilitating the dynamic evolution of the NP and of ensuring that in this process experts from outside the State Administration may intervene, the constitution of "Advisory Groups" linked to each of the priority areas of the NP (non-targeted basic research area, scientific-technological and sectorial areas) has been envisaged. These advisory groups formed by a small number of members (in general between 8 and 12) of recognised prestige and experience, coming both from the public and the private sectors, will be appointed by CICYT.

The functions of the advisory groups will be related, on the one hand, to the continuous evaluation of each one of the priority areas of the NP, based on the results of the monitoring process carried out by the corresponding management body. Besides, the advisory groups will elaborate the reports, which allow for the annual updating of the objectives and the priority thematic lines for each of the areas of the NP. To this end, they will also be provided with the results of the activity of the scientific and technological observatories.

7.3 Basic concepts for the assignment of the management

The assignment of the management (technical and administrative) should be done in two distinct levels:

- **Assignment of the management of an area** means managing the activities associated with the area, with the exception of the strategic actions included in the same area. It may be considered convenient having more than one management body.
- **The assignment of the management of one strategic action** means managing the activities included in the strategic action as well as those derived from its coordination with the rest of the activities of the area in which it is located. In all cases, a single manager will be established.

The assignment of the management of an area for the period covered by the NP to a specific management body means that this body assumes a set of actions that facilitate the management of the calls for proposals and the activities derived activities.

The functions derived from the acceptance of the management are as follows:

- The promotion of the R&D actions related to the area or strategic action among the scientific and technological community, as well as the diffusion of the results obtained.
- The preparation of the necessary open call for proposals in accordance with the guidelines laid down by CICYT.
- The availability in the management body of adequate economic resources to finance the open calls for proposals with the budget determined annually by CICYT.
- The co-ordination of the management of the different strategic actions and horizontal actions in the corresponding area.
- The co-ordination, in co-operation with OCYT, with other management bodies in the same area or with other areas thematically related in those aspects that so require.
- The putting into operation of the evaluation procedures for proposals in accordance with the principles established in the NP.
- The putting into operation of the technical and administrative monitoring procedures in accordance with the principles established in the NP.
- The elaboration of an annual report on the management carried out and on the technical results obtained, which will form part of the Annual Report of the National Plan.
- The maintenance and updating of an Information System on the administrative procedures related to the management.

7.4.1 Assignment of the management

Based on the criteria expressed above, the assignment of management for the different priority areas and for the co-ordination of the horizontal activities of the NP is presented graphically.

Table 4.

Assignment of the management of the area of non-targeted basic research

Area of non-targeted basic research	Management body
General promotion of knowledge	MEC
Astronomy and Astrophysics	MEC
Particle Physics and large accelerators	MEC
<ul style="list-style-type: none"> • Construction of the Spanish line in ESRF (SPLINE) • Common elements in the detectors ATLAS and CMS at CERN 	OCYT
Thermonuclear Fusion	MEC
Diffusion of Science and Technology	OCYT

Sectorial areas	Management body
Aeronautics	MINER
• Advanced structures	MINER
• Advanced aeronautic systems	MINER
• Air traffic and airport management	MINER
• Aerodynamics and propulsion	MINER
Food	MAPA
• New species and technologies in aquaculture	MAPA
• Quality control and food safety	MAPA
• Improvements in the quality and competitiveness of wines	MAPA
Automotive	MINER
• Safety systems in vehicles	MINER
• Recycling and maintenance of vehicles and components	MINER
• Public transport vehicles	MINER
Civil Construction and Preservation of Cultural and Historical Heritage	MF
• Civil Construction and Preservation of Cultural and Historical Heritage	MF
• Maintenance and evaluation of the state of works and buildings	MF
• Preservation of historical building and restoration of the heritage	MEC
Defence	DEFENCE
• Command, control and communications systems	DEFENCE
• Armament, ammunition, gun powder and explosives	DEFENCE
• Weapons and sensor systems	DEFENCE
Energy	MINER
• More efficient and less polluting energy systems	MINER
• Transport, storage, distribution and more economic and efficient use of energy	MINER
• Alternative propulsion systems and new fuel for the transport sectors	MINER
Space	MINER
• Technological developments of subsystems and equipment for small platforms (minisatellites and micro-satellites)	MINER
• On board instruments and experiments for Earth observation, micro-gravity and space science	MINER
• Subsystems and pre-competitive applications in telecommunications, navigation and teledetection by satellite	MINER
Environment	MIMAM
• Management technologies and the treatment of refuse	MINER
• Instruments, techniques and methods for monitoring environmental variables	MEC
• Water treatment and purification	MIMAM
Information Society	MINER
• Education and cultural heritage	MEC
• Advanced public services	MF
• Electronic commerce for enterprises	MINER
• Telemedicine	MSC
Sociosanitary	MSC
• Ageing	MSC
• Health technologies	MSC
• Nutrition and health	MSC
Transport and Land planning	MINER
• Improvement in transport safety	MINER
• Integrated transport management	MINER
• Land planning and sustainable development	MIMAM
Tourism, Leisure and Sport	MEC
• Diversification and improvement of the tourist product	MEC
• Sports material and equipment	MEC
• Increase in quality and safety in tourism and sport	MEC

Table 6.

Assignment of the management of the sectorial areas

Table 5.
Assignment of the
management of the scientific-
technological areas

Scientific-technological areas	Management body
Biomedicine	MEC, MSC
Biotechnology	MEC, MINER
• Genomics and proteomics	MEC
Industrial design and production	MEC, MINER
• Microsystems	MEC
• High speed Mechanisation	MINER
Materials Science	MEC, MINER
Chemical Processes and Products	MEC, MINER
Natural Resources	MEC, MINER
• Protected natural areas	MIMAM
Agrofood Resources and Technologies	MEC, MINER
• Conservation of genetic resources of Agrofood interest	MAPA
• Agrarian Resources and Technologies	MAPA
Information and Communications Technologies	MEC, MINER
• Technologies and experimental services for cable networks	MF
Socio-economic research	MEC, MINER
• Knowledge society	MEC

Table 7.
Assignment of the
co-ordination of the
horizontal actions

Horizontal actions	Coordinating Body
• Improving the R&D human resources	MEC
• International co-operation	MAE
• Technological Innovation, transfer and dissemination of results	MINER

With regard to the assignment of the management, it is also necessary to point out:

- The MAPA, in accordance with the responsibilities derived from the Royal Decrees on the transfer of competencies in the field of agrarian research to the Autonomous Communities, will manage the corresponding R&D activities in a similar way to a strategic action, under the name 'Agrarian Resources and Technologies' in the framework of the scientific-technological area of 'Agrofood Resources and Technologies', sharing the same thematic priorities, among which the Co-ordinating Commission for Agrarian Research INIA - Autonomous Communities will determine those most suitable in each call for proposals.
- The MINER, with the aim of achieving an integrated and coherent vision of its actions in industrial technological innovation and also of facilitating the promotion and management of the same actions in the framework of the NP, will manage the said actions globally, independently of the priority area in which they are applied. In the same way, the MINER will be responsible for the co-ordination of the technological innovation activities for the NP as a whole.
- The OCYT will manage all the activities related to the large-scale scientific-technological facilities, which are its responsibility at the moment. It will also manage those facilities for which it will be given responsibility by the CICYT during the development of the NP.
- The OCYT will manage the Spanish participation and pay the corresponding contributions of the bodies and international programmes for which it is responsible at the present time, as well as those programmes for which it is given responsibility by the CICYT during the development of the NP.

- The strategic action of “Diffusion of Science and Technology” has been included in the area of non-targeted basic research, only as regards its presentation, as its activities and objectives are concerned with all the priority areas of the NP.
- The open calls and subventions of the NP which are financed under Chapter VII of the Research Budget of the General State Budgets, should have procedural coherence and should be examined and reported on by the Permanent Commission of the CICYT prior to their publication. This Permanent Commission will establish the appropriate mechanisms for the co-ordination among the management bodies of the same area, as well as among the different areas of the NP.

Figure 14 shows the set of activities related to a specific area of the NP. It represents, on the one hand, the actions proper to the area and, on the other hand, the horizontal actions which affect transversely all the priority areas.



Figure 14.
Structure of the actions
in the areas of the NP

Budgetary aspects of the National Plan

80

Budgetary distribution

8.1

The third axis of the NP refers to the distribution of the budget for the different activities established. This budget distribution should be considered on two distinct levels:

- Distribution among the different ambits of action of the NP (areas and horizontal activities);
- Distribution among the priority scientific-technical and sectorial areas of the NP.

In order to establish the budgetary distribution, no main changes will be introduced to avoid major discontinuities in the type and volume of financing given to the R&D groups, the technology centres and the enterprises, and to facilitate their re-orientation if needed.

The budgetary distribution should refer to the different activity domains of the NP: non-targeted basic research, scientific-technological areas, sectorial areas, and horizontal actions (improving human resources, international co-operation, technological innovation, transfer and dissemination of results).

In this case, the following aspects should be considered:

- To increase the resources for basic research, both targeted and non-targeted.
- To gradually increase the application of resources for the sectorial areas and the strategic actions. In absolute terms, there should not be any significant decreases in the funds assigned to priority areas.
- To increase significantly the budget devoted to horizontal actions and especially to the actions designed to improving human resources and to encouraging technological innovation, transfer and dissemination of results, with the aim of supporting the strengthening of the R&D groups and the competitiveness of the enterprises and of improving the socio-economic impact of the NP.
- To prioritise the increase of budgetary resources devoted to open calls and to the payment of contributions to international bodies and programmes, with the aim of enhancing the competitive character of the actions of the NP.

Another aspect to analyse is the budgetary allocation in each of the priority areas. The following factors have to be considered in this allocation:

- The areas should have a minimum economic weight, which justifies their inclusion in the NP. The same consideration applies to the strategic actions.
- The priority areas (with the exception of the area of Defence) should be assigned funds, no greater in principle than 10% of the total resources available for open calls for proposals.
- There should be enough flexibility to allow new strategic actions to be included in the NP depending on its dynamic evolution throughout its period of operation.
- The budgetary allocation for each area should be carried out in accordance with the following factors:
 - historical data of the assigned resources;
 - historical data of participation;
 - assessment of the results obtained in the last years;
 - assessment of the prospects of growth in the area, both at national and at international level;
 - strategic and opportunity assessment;
 - Relationship with the resources allocated in the EU.

The allocation will be carried out annually and the fulfilment of the objectives will be evaluated in considering the proposals for the allocation of resources for the following years.

A tentative distribution of the resources will be established for each area and for each one of the types of participation and of financial instruments, with the necessary flexibility for the adaptation of the forecasts to the quality of the submitted proposals.

The allocation of resources to the horizontal activities will be carried out globally and not for individually for each one of the areas. This is due to the fact that many of the horizontal activities have a multi-area application (as may occur with the allocation in some horizontal R&D programmes or in the training of pre-doctoral students, to cite just two examples) or they should be implemented in response to private sector initiatives that may not be linked to open calls (as occurs in some technological innovation activities, in which financial instruments managed outside the State Administration are employed).

The managers of the areas should have sufficient resources available to be able to meet the needs for the management of these same areas, especially for the activities of technical and economic monitoring and for impact evaluation.

8.2 State Administration Research Budget in 1999 (Function 54)

Function 54, called "Technical and Applied Scientific Research", is included in the function 5 group ("Production of public goods of an economic nature") and is the set of budgetary programmes, which include all the credits devoted to financing the scientific and technological policy in the General State Budgets. That is to say, Function 54 is the budgetary instrument to finance the activities started by the State Administration in order to promote scientific research, technological development and innovation activities on the national level. These activities are developed both by public bodies dependent on the State Administration and by other public institutions, non-profit private institutions and enterprises, which receive public financing in the form of subsidies or credits.

Function 54 is divided into two subfunctions: 541 (Scientific research and documentation) and 542 (Technical and applied research) and is structured in budgetary programmes, whose management is carried out both by central bodies of the different ministerial departments and by bodies attached to or dependent on these departments.

The amount allocated to Function 54 in the General State Budgets for 1999 is 460,002.7 million peseta. In Table 8 the breakdown among the different programmes is shown, as well as the ministry which manages the corresponding credits and the economic allocation for each programme in million peseta (MPTA).

Thus, there are nine ministries which manage programmes and credits of Function 54 and which have, therefore, competencies in scientific and technological policy matters. To those, and although they do not have specific programmes in Function 54, both the Ministry of Foreign Affairs, which manages activities related to international co-operation in areas of R&D, and the Ministry of Labour and Social Affairs, which also develops some R&D activities, should be added.

Moreover, Function 54 also includes the credits devoted to financing the R&D activities which are performed by some public bodies which depend on the State Administration, although all of these also obtain to a greater or lesser extent other extra-budgetary economic resources through commercial operations that contribute to their own self-financing. These additional resources generated by these bodies may also come from the public administrations (state, autonomous, or local) or from abroad (mainly from the European Union) as well as from contracts with enterprises.

Programme	Ministry	Provision (MPTA)
541A Scientific Research	Education and Culture	59.082
541B Astronomy and Astrophysics	Education and Culture	1.362
542A Technical Research	Education and Culture	21.641
542B Sociological and Constitutional Research and Studies	Presidency	1.504
542C Research and Studies of the Armed Forces	Defence	49.044
542D Research and Experimentation in Public Works	Development	605
542E Research and Technological Development	Industry and Energy	289.808
542G Educational Research and Evaluation	Education and Culture	673
542H Health Research	Health and Consumer Affairs	15.507
542I Statistical and Economic Research and Studies	Economy and Finance	570
542J Agrarian Research and Experimentation	Agriculture, Fisheries and Food	5.456
542K Fisheries Research and Experimentation	Agriculture, Fisheries and Foo	4.469
542L Geological-Mining Research	Environment	3.486
542M Promotion and Co-ordination of Scientific and Technical Research	Presidency	6.796
TOTAL FUNCTION 54		460.003

Table 8.
Provisions of Function 54 in 1999. Breakdown by programmes and Ministries

Source:
General State Budgets

Table 9 shows the attachment of these bodies to the corresponding programmes of Function 54 and their budgetary allocation for this year.

Function 54 therefore includes the financing of R&D activities of all the bodies which are Public Research Bodies (OPI) in accordance with Chapter II of Law 13/1986. It also includes CEDEX, CEHIPAR, CEPC and CIS, which although cannot be considered as OPI in the strict sense of the Law 13/1986, are also autonomous bodies of the State Administration. All these bodies may also finance themselves through other budgetary programmes not included in Function 54, for the development of activities not strictly related to R&D; this is the case, for example, of the CEDEX and of the "Carlos III" Health Institute. CEDEX receives additional credits to a value of 5,000 MPTA to finance the execution of studies and services of technical assistance in areas of public works and urbanism, while the "Carlos III" Health Institute develops training activities in public health and health administration with a budget allocation of 780 MPTA.

Table 9.
*Provision of the public
bodies funded from
Function 54 in 1999*

Programme	Body	Provision (MPTA)
541A Scientific Research	Higher Council for Scientific Research (CSIC)	39.539
541B Astronomy and Astrophysics	Canary Islands Institute of Astrophysics (IAC)	1.362
542B Sociological and Constitutional Research and Studies	Centre for Political and Constitutional Studies (CEPC)	533
	Centre for Sociological Research (CIS)	971
542C Research and Studies of the Armed Forces	Channel of Hydrodynamic Experiences "El Pardo" (CEHIPAR)	766
	National Institute for Aerospace Technology (INTA)	14.525
542D Research and Experimentation of Public Works	Centre for Studies and Experimentation of Public Works (CEDEX)	605
542E Research and Technological Development	Centre for Energy, Environmental Environmental and Technological Research (CIEMAT)	7.877
542H Health Research	"Carlos III" Institute of Health	15.507
542J Agrarian Research and Experimentation	National Institute for Agrarian and Food Research and Technology (INIA)	5.456
542K Fisheries Research and Experimentation	Spanish Institute of Oceanography (IEO)	4.469
542L Geological-Mining Research	Spanish Institute of Geomining Technology (ITGE)	3.486
TOTAL BODIES FUNCTION 54		95.096

Source:
General State Budgets

Table 10 shows the breakdown of the credits of Function 54 by cost chapter.

Function 54 includes most of the credits devoted to the payment of the contributions Spain must pay for its participation in multilateral programmes, bodies and facilities related to R&D activities inscribed in international agreements for scientific cooperation; these credits are often apportioned in chapter IV. It is necessary to highlight the exception of the contribution for the participation in CERN (European Centre for Nuclear Research), which is paid by the Ministry of Foreign Affairs and is not included in Function 54.

Chapter		Provision (MPTA)	%
Chapter I	Expenditure on Personnel	62.447	13,6
Chapter II	Expenditure on current goods and services	11.953	2,6
Chapter III	Financial expenditure	8	0,0
Chapter IV	Current transfers	5.882	1,3
Chapter VI	Real investments	49.459	10,7
Chapter VII	Capital transfers	96.760	21,0
Chapter VIII	Financial assets	233.494	50,8
Chapter IX	Financial liabilities	0	0,0
TOTAL FUNCTION 54		460.003	100,0

Table 10.
Provision of Function 54
in 1999. Breakdown by
chapters

Source:
General State Budgets

The open calls for proposals carried out by the different ministerial departments in order to encourage R&D&I activities in our country are financed by means of the credits in chapters VI and VII.

Chapter VIII represents more than half of the economic resources of Function 54 and the greater part of it is devoted to the concession of credits to enterprises, both public and private for the development of diverse military projects with an international dimension and in which Spain participates. These projects are important from the technological innovation point of view, because they help to stimulate the technological effort and capability of the Spanish industry. Credits to companies for the carrying out of projects which form part of the programmes for the development of technology and industrial innovation run by the Ministry of industry and Energy fall also within this chapter. Chapter VIII is almost totally assigned (exactly 99,9%) to the Ministry of Industry and Energy for which reason this ministry has become, since 1997, the ministry with the greatest participation in the management of the credits of Function 54. The Ministry of Education and Culture traditionally held this position. Figures 15 and 16 show the distribution of the above mentioned credits among the different ministries. In order not to distort the figures and paying due attention to the peculiarities of Chapter VIII, the same distribution is presented in Figure 16, excluding Chapter VIII.

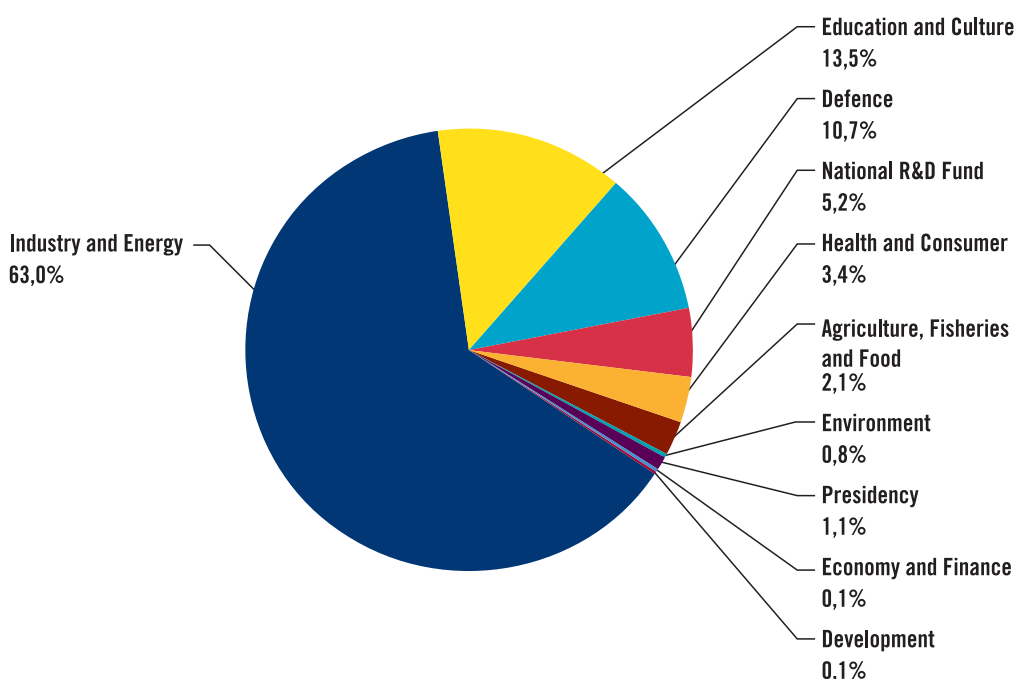
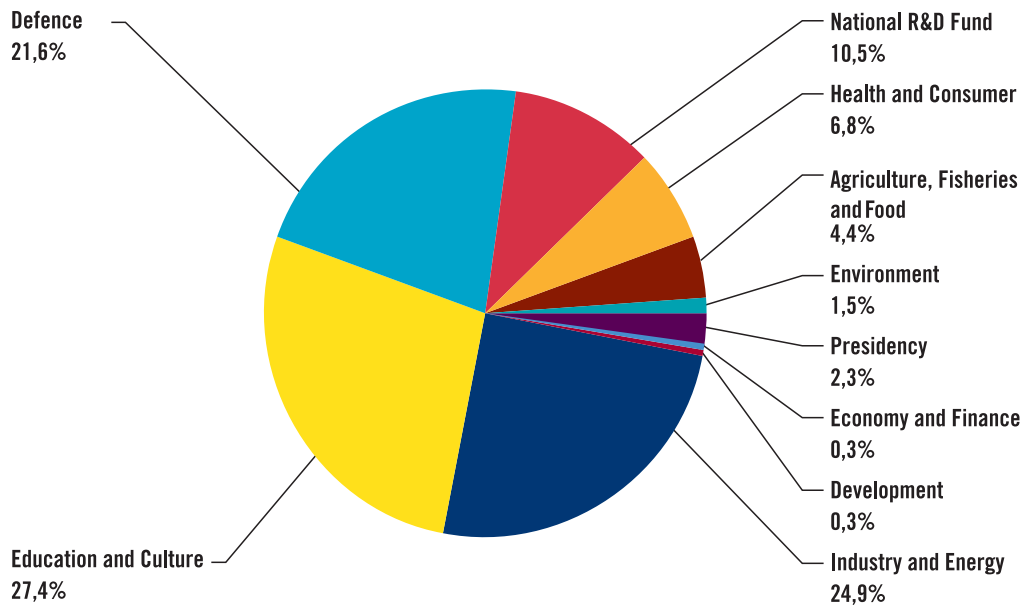


Figure 15.
Percentage breakdown of
Function 54 by Ministries
(1999)

Source:
General State Budgets

Examining the data in Figure 16, it can be deduced that the Ministries of Education and Culture, Industry and Energy, and Defence make up 84.4% of Function 54 (that includes the part of the National R&D Fund that is managed by the Ministry of Education and Culture) and they are therefore the three great ministries which "spend" on R&D. The Ministries of Health and Agriculture manage R&D programmes of great importance in their own particular field, and these two ministries also have their own research centres. The rest of the ministries have a more reduced presence in the management of R&D programmes.

Figure 16.
Percentage breakdown of
Function 54 by Ministries
(1999), Chapter VIII excluded



Source:
General State Budgets

8.3

Evolution of Function 54

Function 54 appeared for the first time in the General State Budgets of 1985, when the budgeting by objectives began to be a general practice.

Figure 17 shows the evolution of the budgetary allocation of Function 54 for the period 1990-2000, in current PTA, and in Figure 18 it can be seen the inter-annual variation for the same period. The allocation shown for the year 2000 corresponds to the provisional figure which is contained in the Draft Law of the General State Budgets for that year.

The budgetary allocation of Function 54 reached a maximum in 1991 and since then it has experienced a series of fluctuations, both positive and negative, beginning to grow again after 1996, and this despite the tight budgetary policy followed in the last few years with the aim of reducing the budget deficit. Effectively, the last few years have seen important growth rates, which reached 46,6% in 1999. Even if Chapter VIII is excluded, the rate of growth shows a clear upward trend, as can be seen in figures 17 and 18.

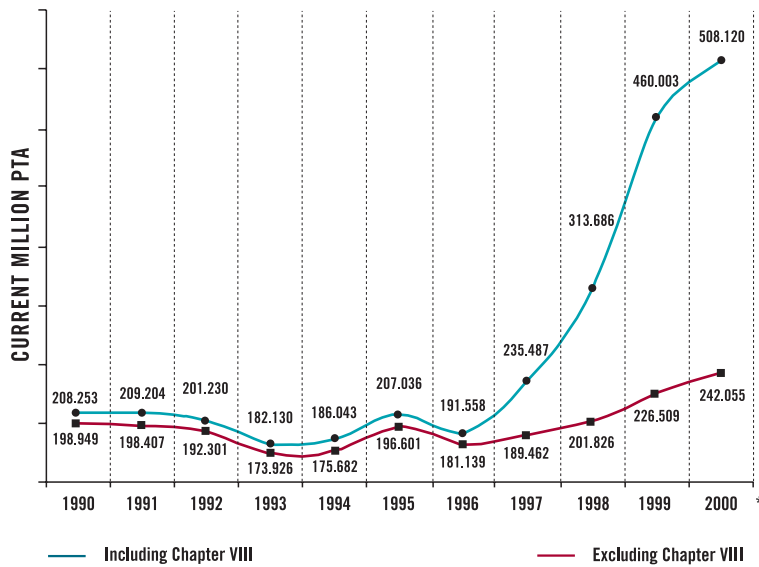


Figure 17
Evolution of Function 54
in the period 1990-2000
(in current pesetas)

(*) Draft General
State Budget
Source:
General State Budget

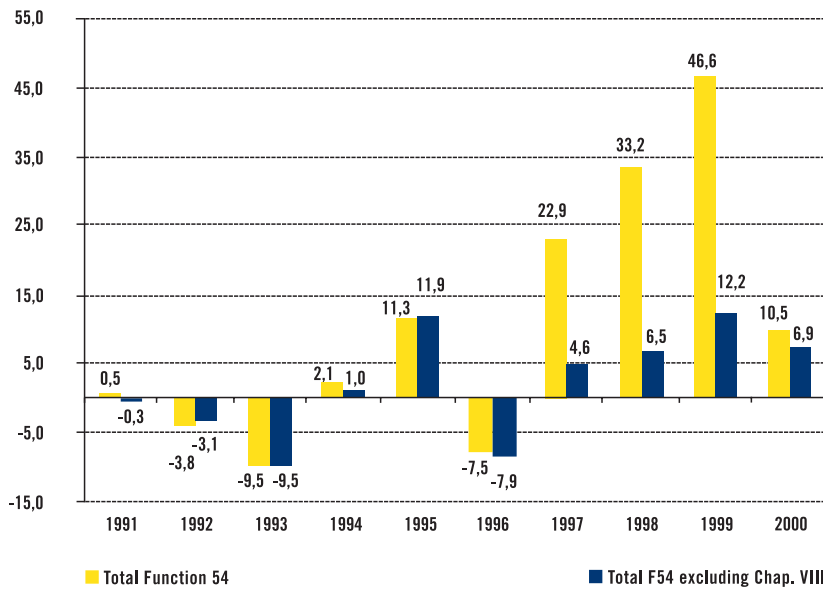


Figure 18.
Interannual variation
of Function 54 in the
period 1990-2000

Budgetary Scenario for the National Plan

8.4

The general hypotheses which have been used in elaborating the budgetary scenario are the following:

- The R&D&I activities should maintain their condition of strategic priority as public spending policy, during the period covered by the NP, with the aim of approaching the figures of R&D recorded in our neighbouring countries.
- The private sector should play a major role in R&D&I activities making significant increases in their investment and the NP for its part should help the private sector by contributing to the creation of a favourable environment to technological innovation and by facilitating the generation of new technology-based industries.

- The growth of the Spanish S-T-E System should be assured by the availability of qualified human resources, both in the public and private sectors, in the necessary quantity and quality and adapted to the needs of the priority areas of the NP.

Considering the previously mentioned principles and being aware that the fulfilment of the objectives is linked to the evolution of the general macroeconomic variables in our country (dependent in its turn on the performance of our neighbouring countries economies), the **budgetary scenario of the NP** is presented in percentage terms.

In the tables, and with the aim of obtaining a clear vision of the situation which allows us to make a better evaluation of the budget effort implicit in the proposed scenario, the data relating to the different chapters of expenditure in R&D and in R&D&I since 1998 have been included.

The tables considered are the following:

Scenario for the financing and the performance of the expenditure in R&D

The scenario related to R&D activities has been subdivided into two parts: the forecasts related to the financing of R&D, in which the reaching of the figure of 1.29% of GDP by the year 2003 has been adopted as a basic objective and the forecasts for performance, in which the basic criterion adopted is that the percentage of R&D expenditure by the private sector should exceed 60%. Both objectives are in line with the situation in neighbouring developed countries and should allow us to reduce the existing gap.

In table 10 the forecast of the financial effort of the public Administrations (showing the State Administration separately from the other Territorial Public Administrations and the Universities own funds), as well as the private financing (which includes the business sector and the non-profit private institutions) are shown.

In this way, the R&D effort of the State Administration, during the period covered by the NP, will continue to exceed the nominal growth rate for the GDP, although this effort will be somewhat attenuated due to the large increases in Function 54 in the last three years. Due to the strengthening of the co-ordination and the improved synergies between the Autonomous Communities and the State Administration, an annual average increase of 10% in the financing from the Territorial Administrations is planned.

For private financing, an average increase of more than 10% is forecast, as a result of the greater involvement by the enterprise sector in this type of activities and the improved financial and fiscal conditions for entrepreneurial investment.

Finally, a small increase in financing from abroad has been considered due to the increments from the European Structural Funds and from international programmes, as well as an improved ability of the actors of the Spanish S-T-E System to attract these funds.

Scenario of financing and performance of R&D&I expenditure

Table 11 shows the forecasts for the total expenditure on research, technological development and innovation activities with the aim of obtaining an overall view of the set of activities covered by the NP. In this case too there is a subdivision of the data concerning the financing of expenditure on R&D&I and the data concerning the performance of this expenditure, using the same criteria as in the previous case, the only difference being that in this case the public financing is considered globally. As regards the expenditure on R&D&I, the forecast objective is to reach 2% of GDP by the year 2003 and with a strong involvement of the private sector in the performance of this expenditure, exceeding the percentage of 76 in the same year, given that technological innovation is undertaken mainly in enterprises. To achieve these objectives, the NP envisages a series of measures designed to promote R&D&I activities in enterprises, so that they can play the key role which is expected from them in the development of the Spanish S-T-E System.

Finally, it is necessary to point out that the allocation of funds envisaged for the NP in these budget scenarios will be complemented by the resources obtained from the Structural Funds of the European Union (fundamentally, ERDF and ESF), which correspond to new programming framework for the period 2000-2006. R&D&I activities will be a priority area in this framework, and it will be concretised in an operation programme integrating the priorities of the various ministerial departments in the application of these funds, designed to contribute to the economic and social development of the less favoured regions. It is estimated that between 7% and 10% of the total Structural Funds made available to Spain, could be devoted to R&D&I activities in synergy with the activities envisaged in the NP.

FINANCING	1998	1999	2000	2001	2002	2003
1. PUBLIC FINANCING						
(% on total expenditure)	51,5	56,7	56,6	54,7	54,3	53,8
1.1 State Administration	40,3 ^(a)	46,9	46,8	45,0	44,4	43,7
1.2 Other Public Administrations ^(b)	11,2	9,8	9,8	9,7	9,9	10,1
2 PRIVATE FINANCING						
(% on total expenditure)	41,9	37,0	36,7	38,2	39,0	39,7
3 ABROAD						
(% on total expenditure)	6,6	6,3	6,7	7,1	6,7	6,5
4 TOTAL EXPENDITURE	100,0	100,0	100,0	100,0	100,0	100,0
5 EFFORT IN "R&D"						
(% of GDP)	0,95	1,12	1,17	1,23	1,26	1,29
PERFORMANCE						
6 PUBLIC SECTOR						
(% on total expenditure)	40,6	36,3	35,6	35,1	34,9	34,7
7 PRIVATE SECTOR						
(% on total expenditure)	59,4	63,7	64,4	64,9	65,1	65,3

Table 10.
R&D Expenditure
Scenario (*)

Notes:
(*) EAS 79
(1979 European Accounting
System)

(a) Liquidation of the budget
of Function 54 (State
Financial Control) in 1998. In
1999 it corresponds to the
initial credits of this function,
and from 2000 on, to an
estimation of the initial
provisions of the same

(b) Includes Function 54 of
Territorial Treasuries and the
Universities own capital

FINANCING	1998	1999	2000	2001	2002	2003
1 PUBLIC FINANCING						
(% on total expenditure)	31,5	36,9	36,3	35,2	35,0	34,8
2 PRIVATE FINANCING						
(% on total expenditure)	64,4	59,0	59,5	60,2	60,6	61,0
3 ABROAD						
(% on total expenditure)	4,1	4,1	4,3	4,6	4,4	4,2
4 TOTAL EXPENDITURE	100,0	100,0	100,0	100,0	100,0	100,0
5 EFFORT IN "R&D&I"						
(% of GDP)	1,55	1,73	1,83	1,92	1,96	2,00
PERFORMANCE						
6 PUBLIC SECTOR						
(% on total expenditure)	24,9	23,6	22,8	22,6	22,5	22,4
7 PRIVATE SECTOR						
(% on total expenditure)	75,1	76,4	77,2	77,4	77,5	77,6

Table 11.
R&D&I Expenditure
Scenario (*)

(*)EAS 79
(1979 European
Accounting System)

Final Considerations

The National Plan for Scientific Research, Technological Development and Innovation, described in this document has been designed with the basic objective of strengthening the Spanish Science-Technology-Enterprise System.

The priority areas identified, the elements included in the planning of each one of them, the modalities of participation and the associated financial instruments, all these elements contribute in an integral manner to meeting the above mentioned objective.

The putting into operation of the NP should be carried out taking into account the following:

- The NP should be an efficient tool at the service of public policies and of society. For this, the following points have been considered:
 - The inclusion of new priority areas, putting especial emphasis on the service sector.
 - The assignment of management responsibilities to new ministerial departments, in order to bring R&D more closer to the preoccupations of the State Administration, and to involve all the State Administration in the management of R&D.
 - The reliance on of independent expert groups for the evaluation of the efficacy of the NP.
- The NP must strengthen a more articulated S-T-E system, with better interactions among the different performing actors and must also reinforce the intermediary institutions. To this end the following points have been considered:
 - The inclusion of modalities of participation, which facilitate the cooperation among different types of actors.
 - The policy of fostering centres of competence (of excellence, technological or virtual) open to society.
 - The co-operation with the Autonomous Communities through joint action packages.
- The NP should consolidate the R&D effort made in the last decade, and contribute to shape the future on the following bases:
 - Strengthening external evaluation mechanisms through ANEP and CDTI, and those for internal evaluation belonging to the relevant management bodies.
 - Development of the public system R&D groups, by making available basic equipment and information access networks.
 - Maintenance of the scientific capability reached internationally, reinforcing the support to basic research.
- The NP should contribute to raising competitiveness of the enterprises, by improving their technological innovation capabilities. To do this, the following steps are foreseen:
 - A set of actions to accelerate the process of incorporating advanced technologies.

- New mechanisms to facilitate the exploitation of the results obtained from public sector R&D activities.
- New financial instruments complemented with new fiscal incentives to support R&D&I activities in enterprises.
- The NP must be much more flexible, adapting its priorities, modalities of participation and financial instruments to the needs of each moment, by means of:
 - The annual updating of the work programmes, based on the continuous evaluation of the NP and the scientific-technological demands of socio-economic sectors of society.
 - The establishment of external advisory groups and scientific and technological observatories.
 - The creation of modalities of participation and innovative and objectively evaluable financial instruments.
- The NP should be much more open to the world, contributing to the configuration of the European and International Science and Technology system, while attempting:
 - To attach greater priority to international cooperation.
 - To participate more decisively in international programmes and bodies.
 - To progressively open its activities to the participation of other European institutions on a reciprocal basis.

These principles have guided the decisions adopted in the design of the NP and will serve as a frame of reference during the next four years.

Glossary of terms

ANNEX

Strategic action

A set of R&D projects, which are closely related and co-ordinated in order to achieve an objective. It is generally linked to sectorial areas.

Horizontal actions

Support activities for the priority areas of the NP. Three types of accompanying measures are considered: improving human resources, international co-operation, technological innovation, transfer and dissemination of results.

R&D activity

Any type of fundable activity that is a potential objective of the NP. By extension, the activity undertaken by a performing actor of Spanish S-T-E system to improve the scientific and technological knowledge, and its application to any sector of society.

Non-targeted basic research area

Activity domain of basic research, non-thematically prioritised and mainly linked to the development of scientific knowledge and to scientific instrumentation associated with large-scale research facilities.

Scientific-technological area

Priority and homogeneous activity domain linked to the development of knowledge in a certain technology or in a domain of scientific knowledge.

Sectorial area

Domain of a priority activity in R&D linked to the interests of a Spanish socio-economic sector.

Centre of competence

Stable organisation, either public or mixed (with contributions from public and private funds) provided with scientific and administrative autonomy, to develop lines of research in a scientific-technological or sectorial area.

Non-profit private R&D centre

Universities and non-profit private entities, with proven capability and activity in R&D actions. Technology centres are also included when their ownership and management have a majority control by the Public Administrations.

Public R&D centre

Public Universities, Public Research Bodies defined as such by the Law 13/1986, and in general, any R&D centre dependent on the Public Administrations.

Technology centre

Centres of Innovation and Technology, recognised and registered as such by the Royal Decree 2609/1996 of 20 December 1996 and which neither their ownership nor their governing bodies have a majority representation by Public Administrations.

Open call

Mechanism for the allocation of economic resources for the fulfilment of an R&D programme, linked to a scientific-technological or sectorial area.

Instrumental axis

Set of mechanisms included in the NP to promote and to channel the participation of the various agents of the Science-Technology-Enterprise System by means of open calls.

Budgetary axis

Distribution by areas and activity axes, of the available public funds to develop the actions envisaged in the NP.

Thematic axis

Identification of the priority areas of the NP and of the priority lines, established in the scientific-technological and sectorial areas of the NP.

Enterprise

Body or institution, whose essential activity consists in the mercantile production of goods and services. Public enterprises are also included here.

Evaluation

A set of activities designed to analyse the impact and the utility of the R&D and technological innovation activities financed through the NP in relation to the objectives that were set by this. Also included is the evaluation of projects, centres, large-scale research facilities, accompanying measures, etc., as well as the areas of the NP and the NP itself as a whole.

Flexibility

The room for manoeuvre envisaged in the NP in the thematic, budgetary and instrumental axes, in order to allow for modifications in the planning during the operation of the NP.

Scientific-technical large-scale research facility

Scientific or technological piece of equipment of a unique or singular character, whose costs of construction or acquisition and operation and maintenance are high in comparison with the average for the equipment in the sector.

Advisory group

Working group, created in each area of the NP to evaluate the activities and to propose the strategy to follow in the concerned area.

Financial instrument

Administrative mechanism used to support, subsidise or finance the activities in the NP contemplated in the modalities of participation.

General framework of the NP

Part of the structure of the NP, which is considered stable for the whole period of operation of the NP.

Modality of participation

Characterisation of a type of activity performed by any agent of the S-T-E system which is capable of being supported or financed by the NP using the appropriate financial instruments.

Scientific and Technological Observatory

Unit selected for the scientific and technological watch in a specific area of the NP, and whose reports will be used to facilitate the decision making in the dynamic evolution of the NP.

National Plan

General framework for the R&D&I activities, which are financed out of the General State Budgets.

Sectorial Policy

Priorities in a specific public sector, decided by the State Administration.

R&D Programme

Set of activities that are carried out in a specific area by means of open calls or technological innovation actions.

Annual work programme

Set of priority activities of the NP for the corresponding year within the general framework defined for the NP.

Project in co-operation

An applied R&D project, undertaken by a group of institutions of different types, which co-operate on a temporary basis for the development of the project.

PYME (Small and medium-sized enterprise)

A small and medium-sized enterprise is one which has less than 250 employees, and whose annual turnover does not exceed 40 million euro or whose annual balance-sheet total does not exceed 27 million euro, and in which 25% or more of its capital or voting rights is not owned by one enterprise or jointly by several enterprises, falling outside the definition of SME.

Monitoring

Set of activities designed to follow the evolution of the R&D and technological innovation activities financed by the NP, both in their technical and economic aspects.

Initials and Acronyms

ANNEX

ANEP	National Agency for Evaluation and Forecasting
TA	Scientific-Technological Area
SA	Sectorial Area
S-T-E	Science-Technology-Enterprise
CDTI	Centre for Industrial Technological Development
CEDEX	Centre for Studies and Experimentation in Public Works
CEHIPAR	Channel for Hydrodynamic Experiences "El Pardo"
CEPC	Centre for Political and Constitutional Studies
CERN	European Centre for Nuclear Research / European Laboratory for Particle Physics
CICYT	Interministerial Commission for Science and Technology
CIEMAT	Centre for Energy, Environmental and Technological Research
CIS	Centre for Sociological Research
CSIC	Higher Council for Scientific Research
ESRF	European Synchrotron Radiation Facility
ERDF	European Regional Development Fund
EAGGF	European Agricultural Guidance and Guarantee Fund
ESF	European Social Fund
R&D	Research and Development
R&D&I	Scientific Research, Technological Development and Innovation
IAC	Canary Islands Institute of Astrophysics
IEO	Spanish Institute of Oceanography
IFGF	Instrument of Financial Guidance for Fisheries
INE	National Institute of Statistics
INIA	National Institute of Agrarian and Food Research and Technology
INTA	National Institute of Aerospace Technology
ITGE	Spanish Institute of Geo-Mining Technology
MAP	Ministry of Public Administrations
MAPA	Ministry Agriculture, Fisheries and Food
MAE	Ministry of Foreign Affairs
MD	Ministry of Defence

MEC	Ministry of Education and Culture
MEH	Ministry of Economy and Finance
MF	Ministry of Development
MIMAM	Ministry of the Environment
MINER	Ministry of Industry and Energy
MSC	Ministry of Health and Consumer Affairs
MTAS	Ministry of Labour and Social Affairs
MPTA	Million peseta
OECD	Organisation for Economic Co-operation and Development
OCYT	Office for Science and Technology
OPI	Public Research Body
OTRI	Office for the Transfer of Research Results
GDP	Gross Domestic Product
FP	EU R&D Framework Programme
NP	National Plan for Research, Technological Development and Innovation
SME	Small and Medium-sized Enterprise
EAS	European Accounting System
EU	European Union



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