CSIC

ACTION PLAN 2006 – 2009

CONSEJO SUPERIOR
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ACTION PLAN
2006 – 2009

**CONSEJO SUPERIOR
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**SPANISH NATIONAL
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PROLOGUE

The best way to represent the activity of the CSIC's 116 institutes, with their entourage of service centres and joint units associated with universities and other bodies, would be to use one of those infinitely subdividing fractal images.

The institution's day-to-day work is enormously complex and dynamic. And it is shaped by powerful a centrifugal force which, from time to time, has to be stopped so we can reflect upon the institution, its environment, and submit it to external scrutiny, so as to plan our activity in the immediate future.

In short, this consists of preparing an «Action Plan». The aim of this plan is to undertake an introspective reflection, situate the institution in its environment, subject it to critical examination by external peers, and to scan the horizon of the different scientific disciplines, in order to derive a set of experiences, methods and goals which can be expected to yield the desired results, which are sometimes foreseen, and sometimes not.

Obviously, over the course of this process failures of internal functioning, unjustifiably isolated efforts and instances of unwarranted wilfulness, will emerge, but in most cases we manage to integrate what is dispersed, aggregate what is fragmented and coordinate the elements that are acting alone, so that the process of preparing this strategic plan is a valuable results in itself, even before we begin to put it into effect, given the fresh knowledge it gives us about the institution itself and the national R&D system.

One hundred years after the creation of the *Junta para Ampliación de Estudios e Investigaciones Científicas* (Council for the Extension of Studies and Scientific Research, or JAE in its Spanish initials), and almost seventy years after it was turned into what is today the Spanish National Research Council (*Consejo Superior de Investigaciones Científicas*, CSIC), it might be considered superfluous to raise the question today as to what the mission, vision and values of this organisation are, as they should be well known by now. However, as I said, the process of introspection has been useful in itself, and has given us new insights into the governance of the institution.

The aim of this prologue, therefore, is to summarise the more conceptually oriented content of the Action Plan and to reiterate our defence of the reference framework of the institution that has prepared it. The work presented here is unprecedented in the history of the institution. Its preparation has involved all its members, thus

leading to a product in which the institution as a whole was reflected.

Before going into the details it is important to highlight that the Action Plan has been prepared in the context of the change in the legal status of the CSIC to that of a State Agency, in which it is precisely medium-term planning which forms the central plank of its operation. The Action Plan has been designed taking into account the immediate context in which the CSIC works, a context which is marked by management responsibility, and in which it is given considerable autonomy and objective-based management mechanisms. The Action Plan will be the fundamental working tool in this new framework and will constitute the basis for the preparation of the management contract with the National Government.

THE CSIC'S MISSION AND VISION

The CSIC's Mission

As stated in the recently passed Law on State Agencies for the improvement of public services (*Ley de Agencies Estatales para la mejora de los servicios públicos*), the CSIC is defined as:

A State Agency whose object is to promote, coordinate, develop and disseminate multi-disciplinary scientific and technological research, with the aim of contributing to the advancement of knowledge and economic, social and cultural development, the training of personnel and providing advice to public and private entities on these subjects.

This definition is based on an implicit conception of the organisation's mission, from which a series of activities naturally arise. These can be grouped along six main axes:

- Generation of knowledge:

  The CSIC is the leading centre for the production of scientific publications in Spain and the most visible Spanish organisation in prestigious international journals. As a State Agency the planning of its research activity will be approved by National Government within the framework of a management contract, without prejudice to its also taking part in the execution of the scientific policies of the governments of the Autonomous Regions, on the basis of prior arrangements and the necessary rationalisation of the available resources, as well as in the science policy priorities of the European Union.

- Knowledge Transfer:

  The CSIC has built up an active policy of contracting R&D with companies and seeking industrial protection of the results it produces so as to facilitate their subsequent transfer. In its career as a State Agency it needs to enhance and deepen this policy, developing lines that were recently embarked upon, such as the creation of technology-based companies or regular high level relationships with companies and business associations. Some of the services it has been providing should be outsourced, as is now permitted under the future legal framework.

- Training:

  The CSIC has a long tradition of training PhDs and specialised technicians. This tradition needs to be taken up and the range of training offered improved and extended in the new scenario. The CSIC should go so far as to offer its own qualifications, either on its own or in conjunction with universities. These CSIC qualifications may lack academic validity, but would be of value in a job market that is ever more demanding and specialised.

- Scientific culture and communication:

  Efforts to foster a scientific culture and communicate science must be continued and bolstered in the context of the CSIC's new legal status, both for reasons of its commitment to society and its public profile. Similarly, the CSIC needs to be involved in programmes to update the knowledge of non-university teaching staff and in projects to create teaching materials.

- International scientific representation:

  The future State Agency will inherit the CSIC's extensive network of international relationships, which are not limited to the implementation of bilateral agreements with counterparts in other countries, but frequently involve the representation of Spain in international programmes, bodies and organisations, which affect the whole national R&D system. In the context of the CSIC's new legal status it must reinforce this service of international scientific representation, which is an area in which Spain needs to correct a significant accumulated delay. The CSIC works with other specialist entities (CDTI, *Instituto Cervantes*) so as to achieve greater presence and increased representation of Spain's citizens abroad. At the behest of the government it also represents Spain in international programmes such as GBIF, EURYI and others. This is all consistent with the fact that the CSIC is the only multisectoral R&D instrument available to na-

tional government and, therefore, is the most appropriate means with which to implement these aspects of its scientific policy.

- Cooperation and management of national facilities:

  The CSIC has been providing services to the whole scientific community through its responsibility for managing large scientific facilities. The example of the Juan Carlos I Spanish Antarctic Base is very illustrative of this. The base is a facility designed, built and equipped by the CSIC, and from the outset, it has been at the service of the whole Spanish scientific community. In this new context the institution needs to configure itself as a tool of national government to manage facilities of this kind in both a national and international framework.

- Expert advice:

  The CSIC's potential customers include both companies, based in Spain and elsewhere, and government departments. In this context the CSIC has been acting as a scientific advisor supplying expert knowledge to national, regional and local governments and other actors requiring advice, in cases of environmental (such as the Aznalcóllar spill or the sinking of the *Prestige*) or public health (such as so-called «toxic oil syndrome» or avian flu) emergencies. As a State Agency it will need to refine its capacity to provide advice and expert knowledge and make it more flexible, and to develop its strategic foresight capabilities in R&D.

The CSIC's mission would therefore best be defined, on the one hand, by its recent history, and on the other, by the visibility given to its most prominent achievements. The preparation of an Action Plan is therefore an opportunity for us to say: *«this is the best of what we have done so far, and this is what we want to continue doing, but better, in the future.»*

The CSIC's Vision

The Action Plan establishes a fairly explicit model for the development of the institution so that from its assumptions it is possible to anticipate the vision of the institution that will be projected into the future.

On the international level the CSIC sees itself as one of the major drivers of scientific research and technology development in Europe. Together with its European counterparts the CSIC is a key actor in the construction of the European Research Area and in implementing mechanisms to turn Europe into a knowledge-based society. This

vision goes beyond the European context and also reaches the international sphere, to become an important point of reference for Spanish research activity for a wide set of countries.

The most significant axis on the national level is the role of the institution as an instrument for various goals. In effect, the CSIC sees itself as:

- A privileged instrument for cooperation with universities, hospitals, research centres and administrative units in the autonomous regions for the implementation of competitive and innovative scientific programmes.
- The ideal instrument for the management of existing or future large facilities, such as BIO Hespérides, RedIris or the «Juan Carlos I» Spanish Antarctic Base. This management may be carried out by the CSIC alone or in collaboration with other bodies, as in the case of the *Centro de Supercomputación de Galicia* (Galicia Supercomputing Centre, CESGA).
- The most appropriate instrument with which to implement Spain's national science and technology policies and to contribute to their formulation.

This instrumental character will further bolster its ability to create synergies within the national R&D system, in which the CSIC wishes to increase the centrality of the position it believes it occupies.

THE CSIC'S VALUES

The CSIC's vision and mission are based on a series of «values» to which the institution has given priority so as to cultivate them in preference to others which may be equally important and valid in themselves, but are not as closely aligned with the institution's mission and purpose.

They are:

- **Scientific excellence:** this is the institution's foremost strategic objective, and that which underwrites its very existence. Excellence is what enables the CSIC to attract the best scientists, justifies other institutions' collaboration with it, enables it to respond to demands from society for expert knowledge, gives meaning to the work of training new researchers and technicians, and explains the transfer of knowledge and technologies to the productive sector. Enhancing this excellence must be an absolute priority and, to do so, we will turn to external evaluation as a matter of course.

- **Ability to respond to society's needs:** unlike other institutions, the CSIC conducts a type of research that is more closely focused on the social and economic needs of its environment. The structure of its scientific areas and the content of its institutions, for example, are not defined according to academic disciplines so much as to socio-economic themes (foods, natural resources, materials, etc.)
- **Multidisciplinarity:** the CSIC's multidisciplinarity, which is to say its having research teams comprising specialists trained in different academic disciplines, is a habitual practice in the institution, which has been bolstered in recent years. This tradition has been particularly useful when it has been necessary to create a team to respond rapidly to environmental emergencies, such as the cases of the breaching of the tailings dam at the Aznalcóllar mine or the loss of fuel oil following the sinking of the tanker *Prestige*, mentioned above.
- **National and European calling:** ever since the creation of the JAE, and particularly since it became the CSIC, the institution has gone beyond the regional or local scale characteristic of universities or certain PROs, and has always had a national, and a European, calling. Its national scope can be seen from the presence of its institutes in all Spain's Autonomous Regions; its European dimension shows in its participation as a founding member of institutions such as the European Science Foundation (ESF), or the setting up of a pioneer office in Brussels devoted to managing R&D projects.
- **Ethical and ideological models:** since the creation of the JAE, the institution has practised and fostered a series of values which have been maintained, even during the most hostile periods of the dictatorship. Principles such as the study and conservation of nature (which explains the creation of «El Ventorillo» by the JAE, or the *Estación Biológica de Doñana* during the dictatorship), the internationalism of science and the consequent necessity of international cooperation (which explains how the existence of scientific relations with Israel or with the countries of the former Soviet sphere predates the existence of diplomatic relations), of the vocation to resolve society's immediate problems (so characteristic, for example, of the former «Juan de la Cierva» trusteeship), or the desire to serve Spanish science, in general, which goes back to Santiago Ramón y Cajal and other illustrious members of the *Junta para Ampliación de Estudios* (JAE). The CSIC considers itself to be the heir to these values and holds on to them as the most valuable part of its intangible legacy.

SUMMARY OF THE PROCESS.

The initiative for the Action Plan came from the institution's presidency, but its preparation has been the task of the institutes and the various executive units. It is, therefore, a plan that has been built from the bottom up, and which has been examined and refined at the successive levels of the institution's higher advisory and governance bodies.

In addition, the process of preparing the plan has benefited from advice from panels of foreign specialists, who have been in direct contact with the area coordinators and the directors and deputy directors of the institutes, who have devoted many hours and much effort to reviewing the documents. No less than 500 people from outside the institution have collaborated in its preparation, such that we can say that this Plan is a collective work and that it is a faithful representation of the prevailing views in the CSIC.

The participation of advisory panels appointed by the European Science Foundation (ESF) and the European Molecular Biology Organization (EMBO) in the process of elaboration is a demonstration of the commitment to «quality assurance» the Plan aims to fulfil during its implementation phase. The specification, in each of its sections, of the objectives pursued and the indicators of the progress towards their achievement, is a first tool with which to avoid undesirable deviations.

The Plan is divided into four volumes. The first, the General Strategic Plan, is devoted to the most general content, those areas which affect the whole institution equally, such as the analysis of the financial budget, the data on human resources, investments, instruments of scientific policy currently in force, or new activities envisaged for the years ahead.

The second volume looks a the Strategic Plans of the Horizontal Units: the Scientific Culture Area, Press and Communications Department, Postgraduate and Specialisation Department, Publications Department, Technology Transfer Office, Information Technology Unit, Scientific Information Systems Unit, International Relations Division, Research Support Programmes, Quality Control Laboratories, and units associated with the CSIC's Large-Scale Facilities. This volume also includes the Horizontal Action on Gender Equity in the CSIC, proposed by the Women and Science Committee.

The third volume covers the Strategic Plans of the eight Scientific and Technical Areas: Humanities and Social Sciences, Biology and

Biomedicine, Natural Resources, Agricultural Sciences, Physical Sciences and Technology, Materials Sciences and Technology, Food Sciences and Technology, Chemical Sciences and Technology. The Strategic Plan for the Humanities and Social Sciences Area does not include the part corresponding to the future *Centro de Humanidades y Ciencias Sociales* (Humanities and Social Sciences Centre) in Madrid, or the current centres, institutes and units that will be located in this centre. These are the *Centro de Información y Documentación Científica* (Centre for Information and Scientific Documentation), the *Instituto de Filosofía* (Institute of Philosophy), the *Instituto de Economía y Geografía* (Institute of Economics and Geography), the *Instituto de Historia* (Institute of History), the *Instituto de Filología* (Institute of Philology), the *Instituto de la Lengua Española* (Institute of Spanish), and the *Unidad de Políticas Comparadas* (Comparative Politics Unit). The Strategic Plan of the future centre and the institutes that comprise it will be written in due course.

Finally, a fourth volume includes the Strategic Plans of the CSIC's centres, institutes and units grouped by Scientific and Technical Areas, except those mentioned in the preceding paragraph.

Altogether this represents a scale model of what we have been doing so far, and what we aim to do, over the next four years, in the CSIC's institutes, centres and units, one hundred years after the founding of its predecessor, the *Junta para Ampliación de Estudios e Investigaciones Científicas*. This activity will be developed within a new legal framework, namely that of a State Agency. This is an innovative new legal framework for the Spanish administration, which incorporates principles of management typical of the most modern and effective public administrations around the world. The CSIC aims to embark on its new journey with all the necessary guarantees of success and has prepared this Action Plan so as to make progress towards the implementation of the new mechanisms of management and to have at its disposal an essential instrument with which to fulfil its mission.

Carlos Martínez Alonso
President

Madrid, May 2006

THE CSIC'S ACTION PLAN FOR 2006-2009: PREPARATION AND CONTENT

GENERAL POINTS

The Action Plan of the CSIC as an institution and the Strategic Plans of its centres and institutes, Scientific Areas and Horizontal Units share a common approach, namely that their mode of operation is based on their achieving objectives. This approach implies that both the CSIC as a whole and its functional elements need to define specific goals and design quantitative indicators of their level of achievement that allow the progress of the Action Plan and Strategic Plans, respectively, to be monitored. Although this approach is common practice in the strategic management of businesses, there is no tradition of its implementation in Spanish research organisations. Nevertheless, when adapted to the unique features of scientific research considered as a process, and harnessed appropriately, it has clear virtues that make it a model that can be translated to the definition of research institutions' strategies. The management of the CSIC decided to implement the objective-based operating model described in this section. The differentiating characteristics of the model are:

1. Self-critical study of the current position and recent historical trajectory.
2. **SWOT** analysis: The institution's **Strengths, Weaknesses, Opportunities and Threats**, and their functional components.
3. Selecting and defining the strategy based on the SWOT analysis.
4. Setting of specific objectives.
5. Definition of quantitative indicators of progress.
6. Forecasting of annual values of these indicators
7. External review and advice by international scientific experts
8. Medium-term distribution of the institute's resources to its functional components.

The **CSIC's 2006-2009 Action Plan** is a complex document comprising various clearly differentiated sections:

- The **General Strategic Plan,** which refers to the institution as a whole (hardcopy and CD).
- The **Strategic Plans of the Horizontal Units,** which refer to the various specific horizontal units rather than being generally applicable (CD only).
- The **Strategic Plans of the Scientific/technical areas,** which present the global analysis of each area, and their respective future strategies (CD only).
- The **Strategic Plans of the Centres and Institutes,** which include specific details of each centre or institute and their specific strategic guidelines (CD only).

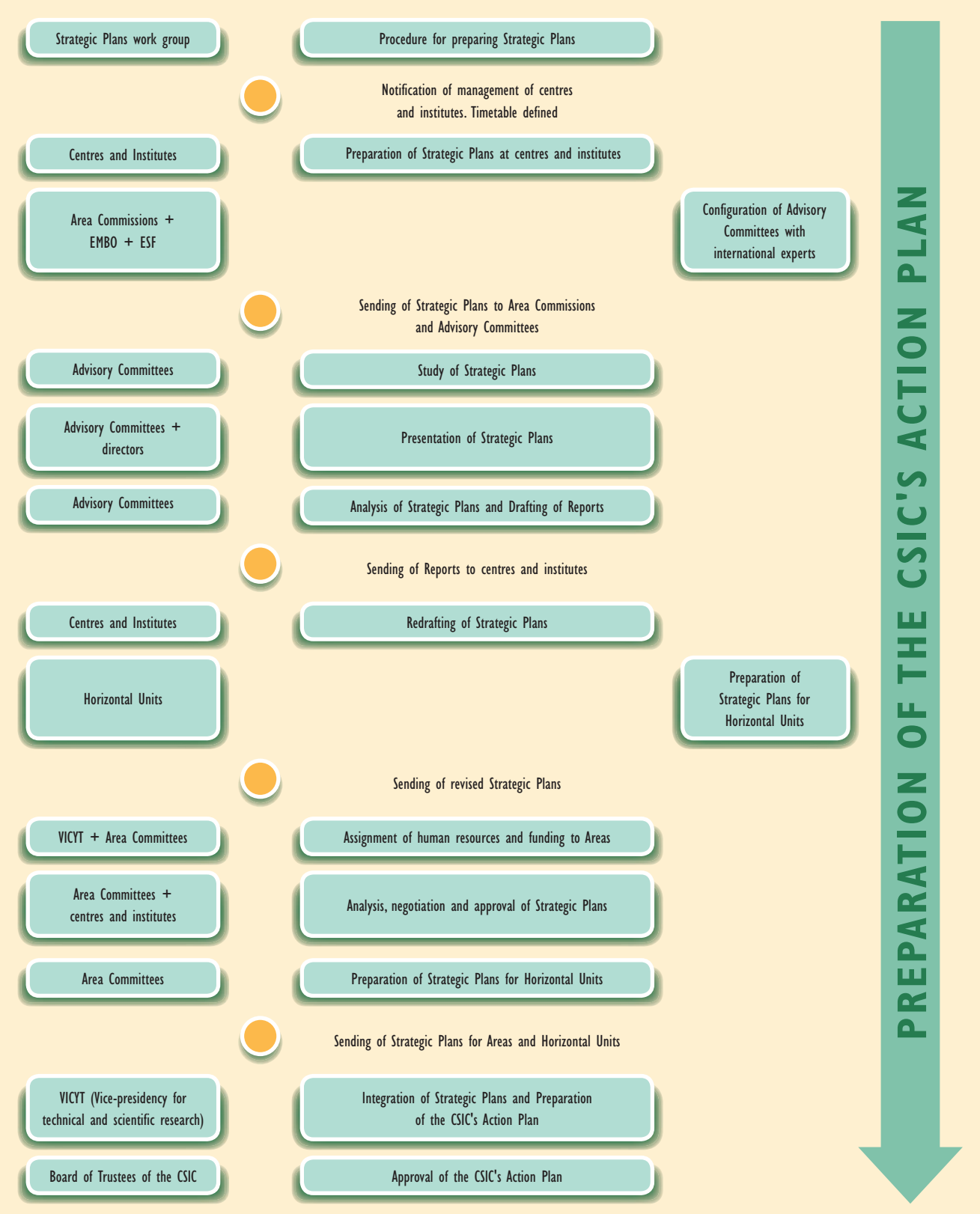
DEFINITION OF THE PROCEDURE

The preparation of the Strategic Plans of the CSIC's centres and institutes and their integration in the institution's overall Action Plan was a painstaking and complex process which was organised in various phases, as shown by the diagram in figure 0.1.

The first phase consisted of defining a common format for the Strategic Plan that would be shared by all the CSIC's centres and institutes. For this phase a work group was set up, and after a

FIGURE 0.1

GENERAL SCHEMATIC OF THE PROCESS OF PREPARATION OF THE CSIC'S ACTION PLAN AND THE STRATEGIC PLANS OF ITS FUNCTIONAL COMPONENTS (CENTRES AND INSTITUTES, SCIENTIFIC AREAS AND HORIZONTAL UNITS)



number of sessions it drew up a general procedure enumerating the different parts that the centres and institutes' Strategic Plans needed to contain. It also included a tentative timetable for the implementation of each phase. An integral part of the Strategic Plans was a set of tables in which centres and institutes had to enter data about themselves in a common format. These tables were supplied pre-designed and some of them already filled in with the data on each centre or institute held in the CSIC's corporate database. As is described below, several data series had to be reported, relating to the centre/institute as a whole, and in a disaggregated way for each of its departments, and optionally, for research groups. To make the subsequent analysis of the data uniform and to differentiate the tables for each centre/institute from those of the departments/groups, different sets of pre-designed tables were supplied.

Once this procedure had been concluded, the management of the centres and institutes were notified so that they could start to prepare their Strategic Plans, in accordance with the common rules contained in it.

STRATEGIC PLAN OF THE CENTRES AND INSTITUTES

The next phase, in which the centres and institutes had to prepare their respective Strategic Plans, lasted for several months. As a general rule, the management of the centres/institutes was asked to involve all their scientific personnel in this process. Each centre/institute had to draw up its Strategic Plan in accordance with the common procedure sent out, and fill in the pre-designed tables of data, included either as annexes or in the body of the text. The departments in each centre/institute were also asked, across the board, to fill out a series of similar tables of data specifically designed for them. In this latter case, some of the general tables of data referring to the centre/institute, which were not applicable to departments, were excluded. A further option, which institutes/centres were encouraged but not obliged to follow up, was to include the details of their individual research groups. Finally, the centre/institute had to incorporate all this information in its Strategic Plan and send it as a single unit to the CSIC's central services. Before doing so, the management was expected to listen to the views of the centre/institute's staff on the strategic plan it had drawn up, although their express approval was not required.

The CSIC's 2006-2009 Action Plan represents an important milestone in the definition of the institution's strategy for the next few years. The self-critical analysis of the current position of the organisation, its centres, institutes and horizontal units, the review by international committees of external experts, the setting of concrete objectives, and the definition of indicators to measure the level of achievement, are the unique characteristics of this Action Plan.

Given that Strategic Plans were going to be reported on by ad hoc committees of international experts, the centres/institutes had to provide at least an English version of their Strategic Plan. The Spanish version was optional. Lastly, to facilitate the initial contact between the members of the advisory committee and the strategic plan of each centre/institute (some of which were very large), the centres/institutes had to provide an executive summary covering, in no more than five pages, what they considered to be the most important points of their strategic plan concerning the future strategy and actions to be undertaken to achieve the proposed objectives. Given that these summaries were intended for the members of the advisory committees, they were only submitted in English.

Advisory Committees

Whilst the centres/institutes prepared their strategic plans, the CSIC's area committees set up the various panels of experts who were to act as advisory committees, providing input to the strategic plans, and proposing changes and addenda for them to be considered by the centres/institutes. These panels of experts were put together with the help of two of the most important European scientific organisations. The European Molecular Biology Organization (EMBO) and the European Science Foundation (ESF) were asked to select international experts (other than Spaniards) who could act as members of the Advisory Committees. The Area Coordinators then had to contact these experts to set up the various panels. In the case of the EMBO, this organisation carried out the whole process itself, directly providing a single advisory committee which gave its input on the strategic plans of all the centres and institutes in the Biology and Biomedicine Area. The composition of these advisory committees is given in the annex to this document.

Due to the thematic diversity of the CSIC's centres and institutes, some scientific areas required several advisory committees focused on the different main thematic lines that fed into the strategic plans of the centres and institutes in the area included in these lines. A case in point is that of the Natural Resources area, or that of Physical Sciences and Technologies, which had five advisory committees each. In the case of centres/institutes belonging to more than one scientific area, the management was asked to clearly separate the parts that corresponded to each scientific area in their strategic plans, and each part was subsequently reviewed by the relevant advisory committee.

Reports from the Advisory Committees

The centres and institutes' Strategic Plans were reviewed by 24 advisory committees comprising 143 international experts, selected by the European Science Foundation and the European Molecular Biology Organization.

The process by which the advisory committees studied the strategic plans and drew up their reports was divided into two phases. In the first phase, each committee was sent the strategic plans of the centres/institutes in its field, together with their executive summaries. Once they had studied them, in the second phase the committees met individually with the director of each centre/institute in confidential meetings lasting thirty minutes to an hour at which the director gave an overview of the strategic plan of his or her centre or institute. During these presentations the centre/institute was represented by its director, or the person the latter had delegated the task to, although they could be accompanied by one or more of the deputy directors of the centre/institute. The members of the advisory committee were allowed to ask the director any questions or request clarification on any point they considered relevant during the presentation.

The Area Coordinator attended all these meetings, acting as an advisor to the members of the committee on specific or general points, characteristics of the Spanish R&D and innovation system or the CSIC as an institution. In some cases the Area Coordinator delegated this responsibility to a member of the Area Commission, who acted as the Contact Officer.

Most of the Advisory Committees met in Madrid, it being the region with the greatest concentration of CSIC centres/institutes. However, some meetings were held in other Spanish cities (see Annex).

Having completed all the sessions of the presentation, the committee, working together, drew up an individualised report on the strategic plans of each of the centres/institutes in its field. The advisory committees also drafted overall reports, in many cases comparing institutes, for each area or sub-area as a whole. In order to standardise the way in which the reports were prepared, a single form was designed with specific answers and points that should be considered and commented upon in the advisory committees' reports.

The individual reports on the strategic plans were sent to the management of the centres/institutes for them to consider and to make the modifications they saw fit to their strategic plan.

Redrafting of the Strategic Plans

The centres/institutes had to evaluate the advisory committees' reports on their strategic plans and make the necessary changes in the light of the suggestions they contained. In principle, the

comments and suggestions in the reports were not necessarily binding upon the centre/institute, and they were not obliged to follow them or make the suggested changes to their strategic plan. However, where differences of opinion arose, the centre/institute had to explain its reasons and justify any alternative proposals it made.

Once the modified Strategic Plan had been re-drafted, the centre/institute had to give its comments, in a separate document, on the changes made and any points where it disagreed with the committee's findings. Once again, the centres' management gave staff an opportunity to express their opinions before the revised strategic plans were sent to the Area Committees for final approval.

RESOURCE FORECASTS

Allocation of forecast resources to the various Scientific/technical Areas

One of the sections of the strategic plans of the centres/institutes included their predictions for future human resources and funding and the anticipated investments during the period the strategic plan is in effect. One part of the financial resources, namely investments, and to a large extent human resources also, will depend in the final analysis on the CSIC's available budget as an institution and the future offers of public employment it is allowed to make. For this reason, this part of the CSIC's Action Plan involved a reflection by the CSIC's management both on the desirable future course of this institution, and also its realistic and probable future course, in order to make a feasible estimate of the future availability of positions in offers of public employment (*Oferta de Empleo Público*, OEP), the recruitment quotas set by the Public Administrations Ministry, and the budgetary allocations from the Ministry of the Economy and Treasury, as well as the external resources the institution might be able to obtain. Although the Strategic Plans were intended to be effective from 2005 to 2009, the process of preparation and evaluation lasted beyond 2005, thus allocations were only forecast for the period 2006-2009.

Once the institution's forecasts for these items had been estimated, they were distributed between the CSIC's eight scientific areas, which in turn, subsequently had to distribute them between the centres/institutes for which they were responsible. The items thus distributed were:

Human resources (open access)
Tenured scientists posts
I3P post-doctoral contracts
I3P technician contracts
I3P pre-doctoral grants

Financial Resources
Scientific infrastructure and small-scale investments

Positions for scientific researchers and research professors for which recruitment is open to external candidates, and all internal promotions, are excluded on account of their exceptional nature. The latter were not included because it was felt that they had less influence on the implementation of the centre/institute's strategic plan. Recruitment by public offer of employment to management and research support personnel positions was also excluded, given their scarcity and the variability with which they are assigned to the institution. Moreover, financial resources corresponding to major investments, such as the construction of new buildings or the setting up of new centres or institutes, large-scale facilities, were also excluded, as were current or one-off expenses for building maintenance, as these are items requiring specific individual treatment.

The initial values assigned to each Area for each of the items included in the distribution were calculated on the basis of a variety of parameters. The various human resource forecasts were distributed according to the total estimated numbers of tenured scientist posts, contractual positions, and grants under the I3P programme forecast for each year (assuming a sustained increase of 10%) and the proportion of CSIC doctoral researchers (permanent or contracted) in each Area. Table 0.1 shows the annual figures for the Human Resources initially allocated to each area.

An estimate was also made of the distribution of financial resources from the budget the institution would be able to earmark for scientific infrastructure in each year (also assuming a sustained annual increase of 10%). However, in order to distribute this between the different Areas it was necessary to define a parameter allowing the relative allocation of infrastructure needed in each Area to be evaluated. Thus a «coefficient of experimentality» (CE) was defined, taking into account the scientific infrastructure necessary per doctoral researcher, on the assumption that the scientific infrastructure needed per person is greater when the experimental component of the research is larger (i.e. a greater coefficient of experimentality). This coefficient was cal-

TABLE 0.1

ANNUAL ALLOCATION OF HUMAN RESOURCES TO EACH AREA OF THE CSIC

YEAR	HUM. & SOC. SCI.	BIOL. & BIOMED.	NAT. RES.	AGRI. SCI.	PHYS. SCI. & TECH.	MAT. SCI. & TECH.	FOOD SCI. & TECH.	CHEM. SCI. & TECH.	CSIC TOTAL
PhDs	**382**	**721**	**545**	**487**	**499**	**538**	**273**	**452**	**3896**
PRE-DOCTORAL PERSONNEL (4 YEARS)									
2006	19	35	27	24	24	26	13	22	190
2007	20	39	29	26	27	29	15	24	209
2008	23	43	32	29	29	32	16	27	231
2009	25	47	35	32	32	35	18	29	253
Total	**87**	**164**	**123**	**111**	**112**	**122**	**62**	**102**	**883**
POST-DOCTORAL PERSONNEL (3 YEARS)									
2006	19	35	27	24	24	26	13	22	190
2007	20	39	29	26	27	29	15	24	209
2008	23	43	32	29	29	32	16	27	231
2009	25	47	35	32	32	35	18	29	253
Total	**87**	**164**	**123**	**111**	**112**	**122**	**62**	**102**	**883**
TECHNICAL PERSONNEL (2 YEARS)									
2006	25	46	35	31	32	35	18	29	251
2007	27	51	39	34	35	38	19	32	275
2008	30	56	42	38	39	42	21	35	303
2009	33	62	47	42	43	46	23	39	335
Total	**115**	**215**	**163**	**145**	**149**	**161**	**81**	**135**	**1164**
TENURED SCIENTISTS									
2006	15	28	21	19	19	21	11	17	151
2007	16	31	23	21	21	23	12	19	166
2008	18	34	25	23	23	25	13	21	182
2009	20	37	28	25	26	28	14	23	201
Total	**69**	**130**	**97**	**88**	**89**	**97**	**50**	**80**	**700**

culated by dividing the historic expenditure by the centres/institutes in each Area on infrastructure costing more than 60,000 euros (data included in the strategic plans of each centre/institute) by the number of doctoral researchers in the Area. The application of this coefficient corresponded relatively closely to the intuitive assessment of experimentality in each Area, with the advantage that it was calculated in an objective and transparent way, and with the added value of giving a quantification of the concept. In order to offset possible artefacts in the CE as a result of background noise introduced by a number of factors, such as inter-annual differences in the purchase values of similar equipment, variations in the numbers of PhDs in the Area, etc. the values of CE were normalised to multiples of 5, taking as the base the

CE of the Area with the lowest value (in this case the Humanities and Social Sciences Area). Given that the calculation of the coefficient of experimentally was based on historical data from the last five years, it was a good measure from which to extrapolate the future direction of research in each Area. However, this historical basis for calculation could also constitute an inertial factor that does not take into account possible future variations in the experimentality of a specific Area. While this effect should not be particularly important in the majority of the Areas, it might be so in the Humanities and Social Sciences Area, which is traditionally less experimentally based than others of the CSIC's scientific areas. There has recently been a shift in attention in the Humanities and Social Sciences Area towards experimental research close to other Areas, such as is the case of research in Archaeology, and to some extent, History, although this trend is increasingly extending to other disciplines in the Area. In order to offset this effect, of which the scale is unknown and difficult to quantify with the currently available data, an estimate was made of the possible progress of this Area in this direction in the near future and the provision of economic resources assigned to the area was increased discretionally, almost doubling the value that would correspond to it by strict application of the coefficient of experimentality. However, the final allocation was made using the Area's CE as the reference. Table 0.2 shows the historical, theoretical and estimated figures for the economic initially allocated to each Area. These allocations are the basis of the *EQUIPA* action of the *FRONTERA* Strategic Line (see chapter 5).

The distribution of the allocations of infrastructure between the different Scientific/technical Areas was made taking into account each Area's **Coefficient of Experimentality.** This coefficient offers a quantification of the scientific infrastructure required per doctoral researcher, on the assumption that the scientific infrastructure needed per person is greater when the experimental component of the research is larger (greater coefficient of experimentality). The coefficient was calculated by dividing the historic expenditure by the centres/institutes in each Area on infrastructure costing more than €60,000 by the number of doctoral researchers in the Area.

TABLE 0.2

DISTRIBUTION OF FINANCIAL RESOURCES BETWEEN THE AREAS IN EACH YEAR

YEAR	HUM. & SOC. SCI.	BIOL. & BIOMED.	NAT. RES.	AGRI. SCI.	PHYS. SCI. & TECH.	MAT. SCI. & TECH.	FOOD SCI. & TECH.	CHEM. SCI. & TECH.	CSIC
2000-2004 (k€)	1,332	31,658	11,869	7,407	22,074	13,217	5,004	9,173	101,735
PhDs	382	721	545	487	499	538	273	452	3,896
Coeff. Exp. (CE)	3.5	43.9	21.8	15.2	44.3	24.6	18.3	20.3	26.1
Relative CE	1	13	6	4	13	7	5	6	7
CE-R Normal	1	10	5	5	10	5	5	5	5
2006	241 / 500	4,555 / 4,200	1,724 / 1,800	1,539 / 1,500	3,152 / 3,000	1,699 / 1,700	862 / 1,000	1,428 / 1,500	15,200
2007	265 / 550	5,011 / 4,620	1,896 / 1,980	1,693 / 1,650	3,467 / 3,300	1,869 / 1,870	948 / 1,100	1,571 / 1,650	16,720
2008	292 / 605	5,512 / 5,082	2,086 / 2,178	1,862 / 1,815	3,814 / 3,630	2,056 / 2,057	1,043 / 1,210	1,728 / 1,815	18,392
2009	321 / 666	6,064 / 5,590	2,294 / 2,396	2,049 / 1,997	4,195 / 3,993	2,262 / 2,263	1,147 / 1,331	1,901 / 1,997	20,233
Total (k€)	1,119 / 2,321	21,142 / 19,492	8,000 / 8,354	7,143 / 6,962	14,628 / 13,923	7,886 / 7,890	4,000 / 4,641	6,628 / 6,962	70,545

CE = Coefficient of Experimentality = 2000-2004(k€)/PhDs). Relative CE = CE relative to lowest value (HUM.& SOC. SCI.). CE-R Normal = Normalised Relative CE in multiples of 5. The numbers in blue are the thousands of euros that would correspond if the Normalised relative CE were applied directly. The amounts finally assigned are shown in red.

Distribution of resources between centres and institutes

Prior to the final approval of the strategic plans of the centres and institutes, the Area Commissions had to distribute the future resources assigned to them across the various centres and institutes they covered. This final phase entailed a process of negotiation between the Area Commissions and centres/institutes and the possible readjustment of the forecasts for the provision of human and financial resources from the CSIC's central organisation. Each centre/institute had initially configured its future objectives based on its expectations of funding from the institution. During the negotiations with the Area Commission the centre/institute had the possibility of redefining its objectives based on the revised forecasts agreed between the Area Commission and the centre/institute. During this phase any possible residual rough edges in the Strategic Plan were cleared up and smoothed out.

Once this phase of the negotiations was completed, the Strategic Plans were approved and considered final. Although the centres and institutes' strategic plans are due to be effective over a period of five years, there is also the possibility of revising and modifying the objectives and other features of the Strategic Plan two years after it comes into effect. These modifications must not entail radical changes in a centre or institute's strategic plan, unless necessitated by exceptional circumstances.

STRATEGIC PLANS OF THE SCIENTIFIC/ TECHNICAL AREAS

Once all the strategic plans of each Area's centres and institutes had been approved, the Area Commission, led by the Coordinator, had to prepare the Area's strategic plan. This obviously incorporates the strategic plans of the centres, but is somewhat more than merely the sum of them. To standardise the preparation of the Areas' strategic plans another document was prepared describing the parts of the process and the aspects to be covered. This document had a similar content to that of the strategic plans of the centres/institutes, with a similar distribution of chapters. The quantitative data in the Area's strategic plan had to match the aggregate figures for the centres/institutes. However, in addition to this work of compilation, the Area needed to conduct an overall SWOT analysis and determine its objectives and the corresponding progress indicator values. Moreover, the Area had to perform a globally encompassing analysis of the state of the research it covered in the CSIC, situating

it in the context of national and international research. Thus, the Area's strategic plan needed to address issues such as:

- Looking for synergies and redundancies between the research lines of the Area's centres and institutes
- Detecting shortcomings in conceptual or technical approaches, or in technology transfer
- Analysing the feasibility and need for new institutes or the restructuring of current institutes
- Significant asymmetries in the distribution of staff by gender or age

These and other aspects which can only be seen from a broader perspective than that of the individual centres/institutes are essential elements that need to be taken into account in the Area's SWOT analysis.

STRATEGIC PLANS OF THE HORIZONTAL UNITS

Alongside the centres/institutes and the Scientific Areas, the Horizontal Areas comprise an additional set of functional elements within the CSIC which are essential for it to function properly. By definition these Units cannot be assigned exclusively to any specific area, as they play a cross-cutting role in providing services to all the Scientific Areas. When preparing the Action Plan of the CSIC as an institution it was also necessary to include the strategic plans of the horizontal units. However, given the differences in their structure, objectives and mode of operation and funding, the model of strategic plan used for the centres/institutes could not be applied directly to the horizontal units. Thus a common procedure was established for all these units which maintained the core philosophy of the strategic plans, **functioning by achievement of objectives**, but greatly simplified the task of preparation of a strategic plan for the horizontal units.

The horizontal units to which this procedure was applicable were:

- Technology Transfer
- Post-graduate and Specialisation Department
- Research Support Programmes
- Publications Department
- Scientific Culture Area
- Communications and Press Department
- International Relations
- Quality Laboratories
- Scientific Information Systems Unit
- Computing Unit
- Units linked to Major Facilities

Once prepared, the strategic plans of the horizontal units were sent to the office of the Vice-President for Scientific and Technical Research, where they were evaluated for their feasibility and integration in the general policy of the institution, and they were adjusted to match the resource allocation forecasts.

THE CSIC'S ACTION PLAN

Once the strategic plans of the centres and institutes, the scientific areas and the horizontal units had been completed a plan of action was drawn up for the CSIC as an institution. As well as integrating all the Strategic Plans of the functional elements (centres/institutes, horizontal areas and units), the CSIC's action plan includes all the institution's general initiatives, actions, structural changes, etc. (general strategic plan, this document). Also on this occasion, although with a logical change of scale, a SWOT analysis was conducted to examine the global functioning of the institution and those of its departments that were not envisaged in any of the strategic plans. It should be noted that the CSIC, as an institution also defined annual objectives and indicators of achievement at the level of the institution. These are elements that will serve as a basis for the preparation of the management contract when the institution changes its legal structure to become an agency.

CONTENT OF THE CSIC'S ACTION PLAN FOR 2006 – 2009

The CSIC's 2006-2009 Action Plan comprises four volumes, of which only volume I (this document) is published in print format. The other volumes are on the enclosed CD. The content of each volume is as follows:

VOLUME I

(CD and print version)

Contains the CSIC's General Strategic Plan. This describes the current situation of the organisation and the SWOT analysis of the CSIC as an institution. Based on this analysis a strategy for the future has been designed, organised into ten main strategic lines.

VOLUME II

(CD only)

Contains the Strategic Plans of the Horizontal Units.

VOLUME III

(CD only)

Contains the Strategic Plans of the CSIC's Scientific/technical areas.

VOLUME IV

(CD only)

Contains the Strategic Plans of the CSIC's centres and institutes organised by Scientific/technical Areas. In those cases where a centre/institute belongs to two or more of these Areas, its Strategic Plan is included in each of them.

THE CSIC'S GENERAL STRATEGIC PLAN








EXECUTIVE SUMMARY

Under the current rules governing the Spanish National Research Council (*Consejo Superior de Investigaciones Científicas*, CSIC) the organisation is obliged to draw up an Action Plan every five years outlining the main activities it plans to carry out over the coming five-year period. Traditionally the CSIC's Action Plan has been prepared bearing in mind the proposals from the Area Coordinators, following an analysis of the institution's needs and future lines of development. In late 2004 the time had come to prepare a new Action Plan for the five-year period from 2005-2009. However, on this occasion the decision was taken to precede it with an exhaustive analysis of the current situation of the CSIC's centres and institutes and their perspectives for growth, development and evolution, as envisaged by their management teams. For this reason a common general procedure was established so that all the CSIC's centres and institutes could prepare their strategic plans in a uniform way. These strategic plans were examined by panels of international experts appointed on an ad hoc basis. These panels analysed the plans, suggested modifications, and where applicable, approved the suitability of these plans to the current situation of the centre or institute, area of knowledge and its competitive situation within the international panorama of the research they perform. Using the reports from these advisory committees, the CSIC's centres and institutes reviewed and modified their strategic plans. These revised strategic plans were used by the Area Committees to prepare a strategic plan for the Area. In parallel, the CSIC's horizontal units also prepared their respective strategic plans. In this case a free format was used, given the big differences in horizontal units' organisation and mode of operation. In addition, a General Strategic Plan was also prepared for the institution as a whole, which is the plan set out in this document. Finally, based on all of these strategic plans, the CSIC's Action Plan was drawn up for the next four years. This executive summary refers solely to the CSIC's General Strategic Plan.

The central plank of the CSIC's Action Plan consists of an analysis of the institution's strengths and weaknesses, and the threats and opportunities arising in the environment in which it operates (a so-called SWOT analysis). According to strengths, weaknesses, opportunities and threats highlighted by the analysis, and the interactions between them, a strategy of future actions has been defined to leverage the institution's strengths to the full, to seek to overcome the weaknesses detected, where possible, to exploit the opportuni-

ties, taking into account the two preceding factors, and to protect the institution against external threats, or at least, anticipate their effects.

A common approach has been taken in the CSIC's General Strategic Plan and the Strategic Plans of the institutes and centres, Scientific and Technical Areas, and horizontal units: operation by the achievement of objectives. This approach implies that both the CSIC as a whole and its functional elements need to define specific goals and design quantitative indicators of their achievement that allow the progress of the Strategic Plans to be monitored.

In general terms the CSIC's overall project for the next few years is the common goal of achieving the consolidation of the institution's position as one of the most competitive research organisations in Europe. This means transforming it into a flexible and competitive organisation, at national and international level, able to generate new knowledge and act as a structuring element in the Spanish R&D system. This structuring role will take place through an active collaboration with the public sector (primarily universities, but also other PROs, technological centres, etc.) and with the private sector, through the efficient dissemination and transfer of new knowledge, so that it can be turned into economic growth and social well-being.

SUMMARY OF THE CSIC'S SWOT ANALYSIS

The SWOT analysis (Chapter 4) has enabled the identification of those elements which may have the greatest influence over the CSIC's strategy over the next few years. The Analysis identifies the CSIC's main strengths to be its **public image**, the **multidisciplinary** nature of its research work, its **research staff**, its efficiency in producing scientific results, the **interaction with the technological and industrial sectors** (which in turn bolsters some of the most important of the other strengths identified by the analysis), and **technology transfer** to the productive sector, in the form of the patents registered each year by the CSIC (the CSIC is the leading Spanish institution in terms of international patent applications).

On the other hand, the CSIC's weaknesses were identified as being those relating to aspects of its management. The **hiring of staff**, **financial management**, **infrastructure procurement**, and the existence of an **excessively centralised organisational structure** were the weaknesses given the strongest negative assessment

in the SWOT analysis. This is largely due to the rules and regulations imposed by national government that the CSIC is obliged to follow in its administrative management. Another important weakness identified in the analysis was the **shortage of own funds for research**, which leaves the institution with little room for manoeuvre to embark on specific research projects which are not eligible for funding through standard public calls for proposals. **Inadequate infrastructure** and a **shortage of technical and management personnel** were two further weaknesses with a strongly negative strategic relevance, indicating that they need to be dealt with carefully in the design of the CSIC's strategy for the coming years. Lastly, also under the weaknesses heading, the **lack of independence** was also identified as a significant weakness, and one that underlies and sums up many of the other weaknesses detected. It is clear that a greater level of independence in decision-making and in management procedures would facilitate the institution's operation and greatly improve the efficiency of its management.

The most important factor under the heading of Threats is the existence of **research centres with more advanced management**. Indeed, although these recently created centres are intrinsically good for the national scientific system, and therefore good for the CSIC, they are also a significant threat for the institution in that they are aggressive competitors for the scarce research resources available, in both material (projects, public provision of infrastructure, etc.) and human terms. Their more modern management structures, which are not subject in many cases to the enormous limitations imposed by national government, and their having a greater level of own funding, mean they can manage research more efficiently and offer researchers better conditions in which to work. This latter point needs to be nuanced, however. Although some of these centres can offer better conditions in which to perform research in the short term, in the longer term their very structure (which is often very tightly focused), may blunt their competitive edge. Given its multidisciplinarity, the CSIC may potentially offer better opportunities for conducting more interesting research, in areas that lie on the borders between disciplines, which although apparently remote from one another, the cross-fertilisation between them can lead to highly fruitful innovations. Another of the threats analysed in the SWOT analysis, which needs to be taken into account in the CSIC's strategy for the future, is the growing tendency of the various public research funding agencies to use the interest-free loan formula to subsidise research projects. Given the limitations on the CSIC's

capacity to take on debt, due to its status as a public body, this form of finance could represent a future problem that needs to be taken into account.

As regards the opportunities available to the institution in its environment, the SWOT analysis identified the new trends towards **interdisciplinary research** as the best opportunity for the CSIC. Thanks to its large-scale multidisciplinarity, the CSIC is the ideal place for the development of interdisciplinary research. Other opportunities identified in the analysis include the **socio-economic demand** from the productive sector for research results and the emergence of **new scientific research niches**. In the first of these two cases, the best valued of the CSIC's strengths are its **interaction with the technological and industrial sectors** and **technology transfer**. Obviously, these two strengths will be of considerable use to it in making the most of this opportunity. In the second case, the institution's multidisciplinarity allows it to tackle new topics and areas of research in a more rapid way than in smaller and more single-theme oriented institutions.

SUMMARY OF THE CSIC'S STRATEGY

Based on the SWOT analysis briefly summarised in the previous section, a strategy was designed which was to be followed over the period the Strategic Plan is in effect (Chapter 5). This strategy was structured around ten major strategic lines, each containing a variety of actions. These strategic lines are summarised below. Their shared overall objectives include:

- Promoting and performing **top quality scientific research.**
- Encouraging **transfer of knowledge** to the productive sector.
- **Training researchers** to a high standard.
- Promoting and transmitting **scientific culture** to society.
- Being present at an **international level**.

***FRONTERA* strategic line**: This strategic line is directed towards promoting and encouraging top quality scientific research in the CSIC. The actions it encompasses centre on providing direct support to frontier research by research groups, and supporting centres and institutions with specific funding for scientific research and equipment. The actions envisaged in *FRONTERA* are:

– ***INTERSECTA* action**: which aims to promote interdisciplinary research bringing together CSIC research groups through the In-

house Frontier Research Projects (***Proyectos Intramurales de Frontera***).

– ***EQUIPA* action**: which will mean that centres and institutes will be able to draw upon the economic resources assigned to them to procure scientific infrastructure more rapidly.
– ***INCENTIVA* action**: which will provide centres/institutes with subsidies for use in research with a view to creating incentives for institutes to acquire research funding and raise their levels of scientific output. The amount each centre/institute receives will be based on the resources it obtains from external sources and the quality assessment of the research it performs.

***TRANSFER* strategic line**: which focuses on the exploitation of research results by means of direct knowledge transfer actions. Among other actions, *TRANSFER* aims to promote the practical application of the results of research undertaken by researchers with basic guidance, so as to raise their awareness of knowledge transfer to the productive sector and open up new possibilities for the exploitation of research results. This line contains several actions, such as:

– A **company: *CSIC-K2B*** *(CSIC-Knowledge to Business)*: which envisages the creation of a publicly owned company with 100% CSIC capital in order to facilitate and promote knowledge transfer.
– **CSIC-Business Economic Interest Groups**: Intended to facilitate significant transfer of knowledge generated to productive sectors and other sectors.
– ***TRANSCIENDE* Action**: which aims to incorporate knowledge transfer in the processes of definition of the CSIC's strategies, to promote recognition of the knowledge transfer activities in selection processes, and promote greater visibility for these activities among the research staff of the CSIC:
– ***PREGENERA* Action**: the aim of which is to promote the creation of technology-based firms and technical service units, opening up a line of finance especially dedicated to the stages prior to their incorporation as companies.
– ***INVERTIA* Action**: with which the Institution aims, through CSIC-K2B, to own a stake in start-up and spin-off companies and technology service units.
– ***JAE-Transfer* programme**: which will be set up to train staff as «prospectors», whose role will be to look for opportunities to transfer the CSIC's research.

– ***INTECNIA* Projects**: the aim of which is to increase the rate of technology transfer to the productive sector. These projects are aimed at basic research work which needs additional research to assess its suitability for transfer to the productive sector.

***OBSERVA* strategic line**: The fundamental aim of this strategic line is to create research networks on trans-disciplinary themes of scientific and social interest. Two instruments will be used for this: **research networks** and **observatories**. This strategic line is structured into the following actions:

– ***REDES* Action**: which will promote the creation of research networks on specific topics requiring a multidisciplinary approach and/or benefiting from active participation in and coordination with various research groups.

– ***OBSERVATORIOS* Action**: involving the creation of observatories as instruments of scientific/technological surveillance which carry out Foresight functions such as alerting and advising the scientific community, society in general, and economic and political sectors of the situation of the thematic areas they were set up to monitor.

***INCORPORA* strategic line**: This strategic line is focused on bolstering the institution's research staff. Firstly, this line aims to enable new researchers to join the CSIC's workforce. Secondly, *INCORPORA* also envisages an analysis of the CSIC's research groups. The actions envisaged in *INCORPORA* are:

– **New Researcher Career**: a new researcher career will be defined, encompassing and expanding on the current one. This new scheme will involve the creation of two new scales: **Associate Scientist** and **Distinguished Research Professor.**

– **Public Offer of Employment**. **Scientific Personnel**: the aim is to increase the posts on offer at the tenured scientist level. The forecast annual allocation of posts for new tenured scientists at the centres and institutes has been drawn up based on the strategic plans.

– ***JAE-Postdoctoral* programme**: replacing the previous I3P postdoctoral programme Numbers of to *JAE-Postdoctoral* contracts have been pre-assigned to each centre/institute with an annual forecast during the period in which the action plan is in effect, as described in the strategic plans of the centres/institutes.

– **Generic *INCORPORA* action**: this generic action encompasses all those actions aimed at enabling trainee researchers at levels

above post-doctoral level reaching the institution through public offers of positions.

- **In-house induction projects:** newly recruited research staff will be supported by in-house induction projects.
- ***GRUPOS* Action**: which envisages an in-depth analysis of the situation of the CSIC as regards the research groups currently operating, de facto, at its centres and institutes.
- ***AGRUPA* Action**: the continuation of the *GRUPOS* action, with the aim of establishing a catalogue of CSIC research groups.
- ***EQUIPARA* Action**: focused on achieving equality of opportunities in terms of access to the CSIC for various disadvantaged social groups and the disabled.
- **Gender Equity Horizontal Action**: This action is aimed at achieving real equality of opportunities in terms of access to the CSIC and to eliminate gender-related differences in the selection and professional promotion processes.

***SUSTENTA* strategic line**. This strategic line is oriented towards increasing CSIC's research support and management personnel numbers. The aim of the actions included in this line is also to improve and enhance management personnel's level of training and automate procedures so they can be made more agile are also envisaged. The following actions are envisaged:

- **New Technician Career**: a technician career will be created within the CSIC, along similar lines to the researcher career structure.
- **OEP-Technician Action**: the public offer of places for technical personnel oriented towards common services for research groups will be expanded.
- **OEP-Management Action**: As a matter of urgency, management places will be offered in the period 2006-2009 in greater numbers and at higher levels than at present.
- **New Management Career**: an R&D management career will be created within the CSIC, along similar lines to the researcher and technician career structures.
- ***FORGES* Action**: This action is designed to train and improve the qualifications of the CSIC's management personnel.
- **e-CSIC Action**: this envisages the updating of all the management IT systems in terms of both their hardware and software.
- ***TELEMACO* Action**: which aims to migrate all the CSIC's internal management to electronic format.

– **Management Structures**: which envisages the harmonisation of the management of the institutes by grouping several smaller institutes together in a single management structure.

RETICULA* strategic line**: This strategic line refers to the network of CSIC centres and institutes. The actions included in this strategic line concern the creation of new centres and institutes. Initiatives along several axes are initially envisaged, such as: **NANOSCIENCE AND NANOTECHNOLOGY AXIS, FOOD SCIENCE AXIS, ENVIRONMENT AND GLOBAL CHANGE AXIS, ENERGY AXIS, CULTURAL HERITAGE AXIS, BIO AXIS, INFORMATION SCIENCES AND TECHNOLOGIES AXIS, PHYSICS AND MATHEMATICS AXIS**. Various **SPECIAL ACTIONS** are also envisaged, such as the **«Colina de los Chopos» project**, the ***Centro de Ciencias de Benasque (Benasque Sciences Centre) and the ***Centro de Encuentros Ignacio Bolivar*** (Ignacio Bolivar Meeting Centre).

***EXPERTIA* strategic line**: This strategic line brings together a variety of training activities aimed at research personnel and experts in scientific fields, technologies or knowledge.

The actions envisaged in this line are:

– **CSIC-UIMP postgraduate programme**

– **Technical training courses**

– **Predoctoral Training Grants-Contracts Programme**: which aims to implement a 2+2 scheme (2 years' grant + 2 years' contract) in accordance with the rules for new trainee research personnel

– ***JAE-Predoctoral* programme**: The heir to the I3P programme, the JAE pre-doctoral programme will maintain and strengthen the previous programme of pre-doctoral grants, upgrading these grants to pre-doctoral contracts in accordance with the 2+2 format.

– ***JAE-Postgraduate* programme**: This programme will the equivalent of the previous I3P Postgraduate programme.

– ***JAE-Technicians* programme**: This training programme aimed at technicians at different levels and with different qualifications is the continuation of the I3P-Technicians programme run in previous years.

***IMAGEN* strategic line**: This strategic line is oriented towards promoting the good image of the CSIC as an institution, both inter-

nally and externally. To this end the following actions will be implemented:

– ***VISIBILIDAD* Action**: The aim of this action is to raise the CSIC's profile in the media.
– ***CONFIANZA* Action**: This action aims to uphold the scientific rigour and integrity of the CSIC: As a part of this action the creation of a CSIC ethics committee, a manual of good practice and a style manual are envisaged.
– ***YO-CSIC* Action**: aiming to foster a corporate spirit among the CSIC's personnel.

***DIVULGA* strategic line**: This strategic line is intended to bolster the CSIC's activities in relation to the dissemination of scientific culture and the popularisation of science. The following actions are envisaged:

– **Creation of a Scientific Culture Unit**: which will coordinate the tasks of communicating science, scientific outreach and supporting the promotion of scientific culture in the CSIC.
– **Master in Communicating Science to Society**: aimed at higher graduates and PhDs with an interest in popularising science.
– **Institutional publications and audiovisual productions**: with a view to creating a stable and up-to-date line of institutional publications and audiovisual productions with information about the CSIC's activities and projects.

***HORIZONTES* strategic line**: bringing together all the lines aimed at internationalising the CSIC. The actions envisaged in *HORIZONTES* will be put into effect over the course of the Action Plan's lifetime, although in some cases, given their scale, it is not envisaged that they will be completed during this period.

These actions are:

– **CSIC «Honorary Chairs»:** which will enable senior researchers to join the CSIC's research group on a temporary or permanent basis.
– **Joint Institutes**: which aims to create joint institutes with various scientific institutions abroad.
– **CSIC «Outstations»:** similar to joint institutes, but without the need for a partner institution in the host country.
– **CSIC overseas aid:** to facilitate the mobility of researchers to CSIC joint institutes and CSIC outstations, a programme of aid

will be set up for pre- and post-doctoral researchers joining these centres for short or medium length periods.

– **Master in International Research Management:** enabling the training of managers of international research programmes.

RESOURCES NEEDED AND OBJECTIVES

The strategy designed for the CSIC's operation over the next four years requires an increase in financial, and more importantly, human, resources (Chapter 6). In terms of financial resources, it is envisaged that an increase in the CSIC's budget of around 25% a year over the lifetime of the action plan would be required. This is consistent with the proposals of the current government in terms of research funding and bolstering R&D activities, as expressed in the INGENIO2010 programme and the future national plan.

As regards human resources, it is foreseen that a significant offer of new places for both scientific staff and research and management support personnel, two of the CSIC's major shortcomings at the present, would be required. The envisaged increase in the CSIC's total workforce at the end of the current action plan would be around 2,300 more people (after discounting the expected retirements).

The CSIC's current General Strategic Plan envisages the achievement of a series of objectives in relation to various indicators which will serve as milestones against which to measure the plan's correct implementation. These indicators are summarised in the table below:

INDICATOR	2005	Δ%	2006	Δ%	2007	Δ%	2008	Δ%	2009
External funding. Income (€'000)	187,504	10	206,254	10	226,880	10	249,568	10	274,525
Articles in ISI-indexed journals	5,444	6.8	5,811	7	6,218	7.7	6,694	8.1	7,236
Articles in international non-ISI-indexed journals	882	3	908	3	936	3	964	3	993
Articles in national non-ISI-indexed journals	799	3	823	3	848	3	873	3	899
Books	393	3	405	3	417	3	429	3	442
National patents applied for	109	5.5	115	16	133	17	155	29	200
International patents applied for	64	9.4	70	33	93	26	117	20	140
Patents licensed to companies	21	19	25	20	30	27	38	32	50
Start-ups	10	10	11	9.1	12	17	14	14	16
Doctoral theses	553	10	608	10	669	10	736	10	810

For a fuller understanding of the proposed productivity increases readers are advised to consult Chapter 6 of this document, in which the indicators are explained and the proposed target values for them justified. It is worth highlighting the institution's commitment to the indicator measuring the number of **articles published in ISI-indexed journals**, for which a target of an increase of more than 50% above the average increase over the last few years is proposed, and the indicators relating to **knowledge transfer**, with substantial increases, indicating the stimulus the institution wishes to give to the commercial exploitation of scientific research.

1 INTRODUCTION

THE CSIC IN THE SPANISH SCIENCE AND TECHNOLOGY SYSTEM

The Spanish National Research Council or CSIC (*Consejo Superior de Investigaciones Científicas*), is a state-owned, multisectoral, multidisciplinary, public research body. It is present throughout Spain, and its primary goal is to promote and carry out scientific and technical research within the framework, and in the service of, Spain's science and technology policy, in order to drive and contribute to the country's economic, social and cultural development.

In accordance with its statute, the CSIC's functions are the following:

- To prepare and execute programmes of science and technology research, and technological innovation that promote research into innovative applications and the advancement of knowledge, in accordance with the government's science policy guidelines and objectives, particularly those in the National Plan for Scientific Research, Development and Technological Innovation (*Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica*) within the scope of its competences.
- Along the same lines, to design and execute five-year action programmes for the performance of science and technology research, and technological innovation activities, that fall within the scope of the CSIC's priority lines of research and lead to the implementation of the institution's Plan of Action referred to in article 8 of its Statute.
- Likewise, to participate in research programmes run by Spain's Autonomous Regions and the European Union under the terms that may be established through the relevant contracts and agreements. These tasks may also be carried out in collaboration with other science and technology bodies, such as universities, other research bodies, technology centres and companies.
- To contribute to the harmonious development of the integrated science, technology and innovation system, in terms of both its territorial distribution and thematic coverage.
- To contribute to the definition of science policy and to the analysis, selection, implementation, evaluation and monitoring of future science and technology priorities, and to advise national and regional government bodies, when requested, on subjects relating to scientific research and technological innovation.

The CSIC, as the largest Spanish institution exclusively dedicated to research, promotes and carries out scientific research of excellence in multiple domains of knowledge. It encourages technology transfer to the productive sector, trains new researchers and bolsters and communicates scientific culture to society.

- To contribute to the training of the institution's research and personnel and technicians so as to match their abilities to the needs of the advancement of science and technology, and guarantee the scientific and technological quality of the research.
- To manage and promote national, international and sectorial research programmes run under the National Plan for Scientific Research, Development and Technological Innovation, or those arising out of agreements with the Autonomous Regions or the European Union, managing, maintaining and developing installations and resources at the service of science and technology activities entrusted to it.
- To promote the implementation of new technologies, arranging with companies and other agents in the productive sector any R&D and innovation-related initiatives that contribute to economic and social development, without prejudice to the competencies attributed to other national government bodies.
- To collaborate with government departments, social actors and the productive sector on all tasks necessary for the resolution of societal problems for which a science or technology response is required.
- Any other functions entrusted to it by central government or any other functions undertaken with a view to bolstering scientific and technological research.

BRIEF HISTORICAL OVERVIEW

Before the CSIC: The Council for Scientific Research and the Extension of Studies or JAE

Today's CSIC was created in 1939 from the seed of the former Council for Scientific Research and the Extension of Studies or JAE (*Junta de Ampliación de Estudios e Investigaciones Científicas*). On 11 January 1907 the Council for Scientific Research and the Extension of Studies was created by a ministerial decree signed by Amalio Gimeno, Minister for Public Instruction and Fine Arts. The aim of this new body, which inherited the principles of an independent teaching institution, was to end Spain's isolation and forge links with European science and culture. It also aimed to train the staff responsible for implementing the reforms needed in the sphere of science, culture and education. Thus, the effort to reform and regenerate the country became a national undertaking independent of political vicissitudes and in which intellectuals of various ideologies were involved.

The scientific and cultural programme implemented by the JAE not only represented the most innovative project in Spain between 1907

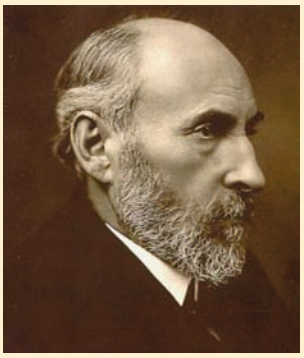
and 1939, involving as it did the creation of laboratories and research centres, the awarding of grants to study abroad, etc. but also brought leading Spanish thinkers and scientists into contact with their counterparts in other countries and on other continents, thus opening up a new way of bringing peoples together through science and culture.

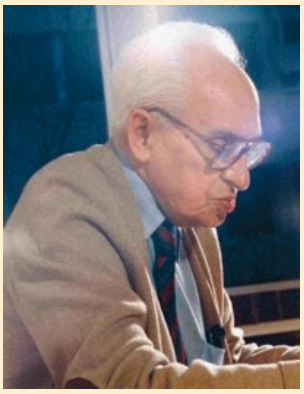
Presided from the outset by Santiago Ramón y Cajal, with the collaboration of José Castillejo in the Secretariat, the JAE had a number of different goals. These included: a study extension service, in Spain and abroad, delegations at scientific conferences, a foreign information service, and international relations in education, promotion of scientific research, protection of educational establishments in secondary and higher education.

To achieve these aims the JAE ran an active grant-awarding policy, and its grants were an essential feature of cultural and scientific development in Spain, benefiting countless students, lecturers and researchers, who we awarded scholarships to work in Spain, Europe and America. From the outset the JAE implemented an active policy to promote the setting up of various research centres and laboratories throughout Spain. These included the *Centro de Estudios Históricos* (Centre for Historical Studies) in Madrid (1910) directed by Ramón Menéndez Pidal, the «*Residencia de Estudiantes*», and the *Instituto Nacional de Ciencias Físico-Naturales* (National Institute of Physical and Natural Sciences), founded in 1910, under the presidency of Ramón y Cajal with the assistance of Blas Cabrera, which grouped together existing institutions such as the *Museo Nacional de Ciencias Naturales* (National Natural Sciences Museum), the *Museo Antropológico* (Anthropological Museum), the *Jardín Botánico* (Botanical Gardens) and the *Estación Biológica de Santander* (Santander Biological Station), and which had various commissions and laboratories, such as the biological research laboratory, physical research laboratory, the *Estación Alpina de Biología de Guadarrama* (Guadarrama Mountain Biology Station), the *Misión Biológica de Galicia* (Galician Biological Mission), the *Comisión de Investigaciones Paleontológicas y Prehistóricas* (Palaeontological and Prehistoric Research Commission), the *Seminario Matemático* (School of Mathematics) and the *Residencia's* laboratories of chemistry, physiology and bacteriology, etc.

Doctors, biologists, chemists, historians, philologists... men and women of science and the arts who were trained in the institutions created by the JAE and who were given the task of implementing the programme to breathe new life into Spanish science and culture.

Santiago Ramón y Cajal, Ignacio Bolívar, José Castillejo, Luis Simarro, Juan Negrín, Pío del Río-Hortega, Antonio de Zulueta, Severo Ochoa,





Santiago Ramón y Cajal (top), Blas Cabrera (centre) and Severo Ochoa (bottom) were important figures in the birth and development of the JAE and the CSIC.

When the JAE was closed, the war caught some of its scientists abroad, and they never returned. Others decided to leave everything behind and flee. Yet others stayed on in Spain. America, and various European countries, opened their doors to these scientists and intellectuals, and contacts had existed with some of them before the war had started. Many of those who fled the war were able to reconstruct Spanish science and culture in exile. Some of these scientists, closely linked to the «*Casa de España*» in Mexico, would be go on to found the journal that reunited the diaspora of Spanish scientists «*Ciencia. Revista hispano-americana de Ciencias puras y aplicadas*» (Science. Hispano-American Journal of Pure and Applied Science). The first issue of the journal was published on 1 March 1940 under the direction of Ignacio Bolívar Urrutia. The three chief editors were Cándido Bolívar Pieltain, Isaac Costero and Francisco Giral.

Julio Rey Pastor, Francisco Durán i Reinals, Blas Cabrera, Leonardo Torres Quevedo, José Casares Gil, José Fernández-Nonídez, Cruz Gallastegui, Federico de Onís, Ramón Menéndez Pidal, María de Maeztu, Tomás Navarro Tomás, Américo Castro, Antonio García Solalinde, Samuel Gili Gaya, Rafael Altamira,... are just some of the people who took part in this enterprise.

Then, in the midst of the Spanish Civil War, on 19 May 1938 the JAE was closed down and its centres and laboratories shut. In 1939, out of the JAE's laboratories, premises and centres Franco's newly installed regime created the *Consejo Superior de Investigaciones Científicas* (Spanish National Research Council, CSIC) under the presidency of the Minister for Education, José Ibáñez Martín, with the close collaboration of José María Albareda, who was appointed Secretary General of the CSIC: The Law passed on 24 November 1939 creating the CSIC laid down that «all the centres belonging to the dissolved *Junta para Ampliación de Estudios e Investigaciones Científicas* (Council for Scientific Research and the Extension of Studies, JAE), the *Fundación de Investigaciones Científicas y Ensayos de Reformas* (Foundation for Scientific Research and Reform Trials) and those created by the *Instituto de España* (Spanish Institute) would become part of the *Consejo Superior de Investigaciones Científicas* (Spanish National Research Council»).

The transitional period

In early 1938, the *Junta Técnica de Estado* (State Technical Committee), which had been set up to direct the administration during the early moments of the civil war, was replaced by a proper government, which took on the task of creating a new state. Its main articulation of this in the research field was stated in the decree of 19 May 1938, conferring on the *Instituto de España* (Spanish Institute) the mission of guiding and directing culture and scientific research in Spain («*Decreto confiriendo al Instituto de España la misión de orientar y dirigir la alta cultura y la investigación superior en España*»).

This text, which extolled Marcelino Menéndez Pelayo, aimed to articulate «Spanish science and culture according to the aspirations of the Master,» by which it referred to Menéndez Pelayo. This text was a clearly ideological discourse arising out of a perceived need to strengthen the national consciousness and eliminate the «fatal slavery of coteries and parties.»

Measures were announced intended to give back to universities the means and competencies to do research, which together with professional training, was considered to be the universities' mission. This

legislation had to be completed by new legal instruments to implement the provisions of the decree.

The decree shut down the JAE and transferred most of its competencies to the *Instituto de España* (Spanish Institute). It postponed a decision on the competencies and institutions that were going to be given to the universities and those that were going to be closed.

In honour of Menéndez Pelayo various research institutions, with a historical and literary focus, were set up:

- The *Centro de Estudios Históricos* (Centre for History Studies)
- The *Centro de Filología Románica* (Romance Philology Centre)
- The *Centro de Filología Semítica y Estudios Arábigos* (Centre for Semitic Philology and Arabic Studies), for which one of the seats was established in Granada
- The *Centro de Arqueología e Historia Americana* (Centre for Archaeology and American History), based in Seville
- The *Comisión para la Historia de la Ciencia Española* (Commission for the History of Spanish Science)
- The *Comisión para formar una Biblioteca de Autores Españoles* (Commission to Create a Library of Spanish Authors) and the *Seminario de Filología Clásica* (School of Classical Philology).

It was also stated that institutions concerned with the study of natural sciences and mathematics would soon be created.

As soon as the war was over, a new decree was published (26/04/1939) providing for the creation of centres of a «scientific, philosophical and even technical» nature. This was placed under a form of lay trusteeship under the name of Santiago Ramón y Cajal. The centres that were created were:

- The *Centro de Estudios filosóficos y Matemáticos* (Centre for the Study of Philosophy and Mathematics)
- The *Seminario «Juan Luis Vives» para Estudios Pedagógicos* (the *Juan Luis Vives* school of pedagogic studies)
- The *Seminario «Huarte de San Juan» de Psicología Aplicada* (The *Huarte de San Juan* school of applied psychology).
- The *Centro de Exploraciones y Estudios Geográficos Juan Sebastián Elcano* (The *Juan Sebastián Elcano* centre for geographic studies and exploration), which was based in San Sebastián
- The *Centro de Estudios Biológicos y Naturales* (Centre for biological and natural studies), together with the «Ramón y Cajal» biology laboratory and a chemistry and biology laboratory.

The declaration of purpose highlighted «the will to renew the glorious scientific tradition», basing it on the «restoration of the classic Christian unity of the sciences which was shattered in the 18th century.» These principles, inspired by the new political regime in Spain, drew upon the ideas of the thinkers of the European counter-revolutionary ideology of the late 18th century, which was the period to which the regime wanted to hark back.

- The *Sociedad y Museo de Ciencias Naturales* (Society and Museum of Natural Sciences), with the laying out of the zoological and botanical gardens, the Spanish geological cartography project, special museums of applied mineralogy, petrography and crystallography, oceanographic stations and biological-stock rearing studies.
- *Centro de altos estudios de Física, Química y Mecánica* (centre for advanced research in physics, chemistry and mechanics)
- Service for the editing of the *Enciclopedia hispánica*

The Founding law

A few months later the project was redefined by the creation of the *Consejo Superior de Investigaciones Científicas* (Spanish National Research Council). The premises and competencies of the JAE, the *Fundación de Investigaciones Científicas y Ensayos de reformas* (Foundation for Scientific Investigations and Reform trials), which had been created a few months earlier by the Spanish Institute, and all those belonging to the National Education Ministry that were not linked to a university, were transferred to the new institution.

The immediately preceding period was written off as being one of «poverty and paralysis» and a recovery of the spiritual energy of «Spanishness» was proposed as a means of creating a universal culture. The idea of demonising the JAE and creating an institution with the opposite ideological principles stands out from all the legal texts and in the writings of the leading management figures in the earliest beginnings of the CSIC.

These ideological forces were a burden on scientific activity for a considerable time, particularly in fields most sensitive to them. However, these restrictions were generalised in Spain at the time and not limited exclusively to the CSIC, which stood head and shoulders above other institutions conducting research in the country, including the universities.

The new institution was set up in collaboration with the *Reales Academias* (Royal Academies) and those university lecturers who had survived the purges, some of whom had worked previously with the JAE.

Initially it was assigned a «coordinating and catalysing» function, highlighting that it should not «interfere with centres and institutions that were developing independently.»

Like the project it replaced, it had to take on the role of relations with counterpart institutions abroad, and the need arose to encourage visits to other countries.

The introduction to the founding law mentions the tree of science and that it is necessary to «promote its harmonious growth and development, avoiding the excessive growth of some branches, and the atrophying of others.» This allegory of the tree of science is the origin of the pomegranate tree that has remained on the logo of the CSIC to this day.

How the system is structured

The importance of the new institution was clear from its position in the hierarchy of national bodies. It was under the trusteeship of the head of state, and its president was the national education minister.

The fact that the president of the CSIC was a minister allowed the institution to be run by a secretary general, José María Albareda, who had a close hand in shaping its development.

Initially, the CSIC did not have a permanent staff of its own, but drew upon scientists from the other institutions listed in article 2 of its Founding Law. As well as providing personnel, these institutions were represented at plenary sessions.

The Regulation of 10 February 1940 modified and extended some of the provisions of the CSIC's Founding Law and established its governing bodies, which were: a Plenary Council, an Executive Board and a Standing Committee. It also set up a number of special-purpose bodies, namely the board of trustees, a scientific exchange and bibliographic committee (*Junta Bibliográfica y de Intercambio Científico*), and a Latin-America committee (*Comisión Hispanoamericana*).

The text also listed the various boards of trustees. Like the various institutes, each board was given the name of a Spanish scientist: Raimundo Lulio (Philosophy, theology, jurisprudence and economics), Marcelino Menéndez Pelayo (Humanities), Alfonso el Sabio (Physics, chemistry and mathematics), Santiago Ramón y Cajal (Biology and natural science), Alonso de Herrera (Agriculture and forestry science), Juan de la Cierva Codorniú (technical and industrial research).

These six boards of trustees brought together nineteen institutes and were responsible for relations with other centres reporting to the various ministries.

There were also two bodies with cross-cutting responsibilities: the Bibliographic and scientific exchange committee (*Junta Bibliográfica y de Intercambio Científico*) and the Latin-America committee

(*Comisión Hispanoamericana*), which was in charge of scientific exchanges with Latin America.

The regulation reiterated and complemented some of the formulae originally expressed in the founding text. Firstly, it mentioned the «traditional unity of Spanish science», and the continuing need to strengthen the «spiritual empire of Spain.» Although in a somewhat marginal way, it also mentioned the fact that technical research should be subordinate to «the economic needs of the nation», and it specifically mentioned the «Juan de la Cierva Codorniú» board of trustees, whose efforts should be aimed at «developing national economic independence and the country's technical progress.»

A fundamental aspect of the new body was its connections with the universities and technical colleges, a principle that was enshrined in the regulation and even enabled their incorporation. It also introduced rules for grants for study abroad, collaboration with other countries and the appointment of official delegations at international scientific conferences.

Responsibility for publishing, setting up a library network and publications exchange, was given to the Bibliographic and scientific exchange committee (*Junta Bibliográfica y de Intercambio Científico*).

The first reforms

As early as 22 July 1942 the first amendments were made to the CSIC's Founding Law. These introduced a number of modifications. Firstly, there the presidency was divided between an ex officio president (the National Education Minister) and an executive president. The number of institutions represented in the plenary sessions was also increased to allow for the new institutions created by the new regime. One of the most important changes was the grouping of the boards of trustees into three sections (humanities and social sciences; science and technology; and biology and natural resources), each of which was headed by a vice president. Both the structure of the sections and the thematic vice presidencies were maintained over the following four decades. The position of technical research director was also created.

CURRENT LEGAL SITUATION OF THE CSIC

The CSIC's current status was passed into law by Royal Decree 1945/2000, 1 December 2000, which was modified by Royal Decree 179/2004 of 30 January 2004 (BOE 12/02/2004). This defines a regulatory structure for the CSIC which takes its special characteristics

very much into account, relating them to a functional structure that not only matches the organisational and operational requirements arising out of the application of the legislation in force, but also to the need to account to society for the quality of its science and technology (S&T) research, its productivity and the effectiveness and efficiency with which it operates.

It is therefore obvious that the CSIC, on account of its historical tradition and current situation, needs to be configured as a multidisciplinary science and technology institution with centres throughout Spain, permanently open to contributions to progress in science and technology from other institutions from Spain and abroad, in accordance with the general requirements of science policy and the organisation's mission.

This mission is none other than the pursuit of scientific and technological research in the framework of, and in the service of the country's science and technology policy, in order to promote economic and social development in the broadest sense.

The Spanish public Science, Technology and Innovation system comprises 67 universities (higher education sector) and nine public research bodies linked to various different ministries. These include the CSIC, which is currently assigned to the Ministry of Science and Education, to which it reports through the State Secretariat for Universities and Research.

The CSIC's exclusive dedication to research, the multi-sectoral and multidisciplinary nature of its activities (which encompass everything from basic research to technology development and cover almost all fields of knowledge), its presence in all the Autonomous Regions of Spain, and its multitude of dynamic relationships with universities, other public research organisations and the Autonomous Regions, as well as companies active in research, together mean it occupies a special place among Spain's Science and Technology Institutions.

For all these reasons the CSIC is a decisive tool in Spain's national science and technology policy, and it plays a highly active role in the implementation of S&T research and advice in the context of that policy. It fulfils its mission either by promoting basic research in strategic sectors, which is used to orient the definition of future action priorities, or by supporting efforts to find solutions to immediate technical and socio-economic problems by promoting applied research and developing its results in a sustainable and holistic way.

The CSIC today consists of a network of 126 centres and institutes, of which 116 are research centres (76 are CSIC-only centres and 40 are

The CSIC today is made up of:

- 116 research institutes: 76 CSIC-only centres and 40 joint centres with other bodies.
- 9 service centres
- 1 technical centre.
- 144 associated units.
- Numerous experimental farms, research vessels, observatories, large installations and unique facilities, and the country's widest and most complete network of libraries.
- 12,479 employees: 3,202 scientists, 3,806 research fellows, 5,471 research technicians, administrative staff and maintenance personnel.

joint centres with universities, Autonomous Regions or other bodies), 9 are service centres and 1 is a technical centre. The CSIC's centres are distributed throughout Spain, with the exception of the *Escuela de Arqueología de Roma* (Rome Archaeology School) in Rome, Italy. This network of centres and institutes is backed up by a significant range of infrastructure, including experimental farms, research vessels, observatories, large installations and unique facilities, and the country's widest and most complete network of specialist libraries. To this should be added the more than 144 associated units made up of university groups and departments, hospitals and technology centres, working on projects and lines of research that are closely related to the CSIC. A total of 12,479 people work for the institution, of whom 3,202 are scientists, 3,806 are research fellows and a further 5,471 are made up of research technicians, administrative staff and maintenance personnel.

All together, these characteristics, along with the numerous and varied interactions between the CSIC and other public research organisations (PROs), universities, local and regional bodies, as well as companies, confer an important role on the CSIC in the structuring of the Spanish Research, Development and Innovation system.

Although the CSIC's scientists and technologists account for just 6% (approximately) of all researchers working in R&D in Spain, their work produces a clearly higher percentage of the country's total scientific output (20% of Spain's total scientific output) and makes a disproportionate contribution to knowledge transfer to the productive sector (25% of the patents produced by the public sector) and to society in general.

To the CSIC's activity in the context of the Spanish R&D and innovation system should be added its activity on the international level, with close to 450 projects in the European Framework Programme underway in 2005, with total funding of more than €90 million, as well as bilateral and multilateral cooperation with 40 organisations in 29 counties and a presence in various international forums, such as the European Science Foundation, EUROHORCS, etc. All in all, this makes the CSIC an organisation of undisputed significance and the backbone of science in Spain.

From this short description of the mission and activities of the CSIC it may be concluded that it plays a crucial role in the Science and Technology system, going beyond that of a body devoted solely to performing research. It also goes beyond the role of merely preparing statistics and reports, or providing technical services. The CSIC is a central component and an integral part of Spain's scientific and technological development. It stimulates the system as a whole, shares its resources with other players which it supports in their

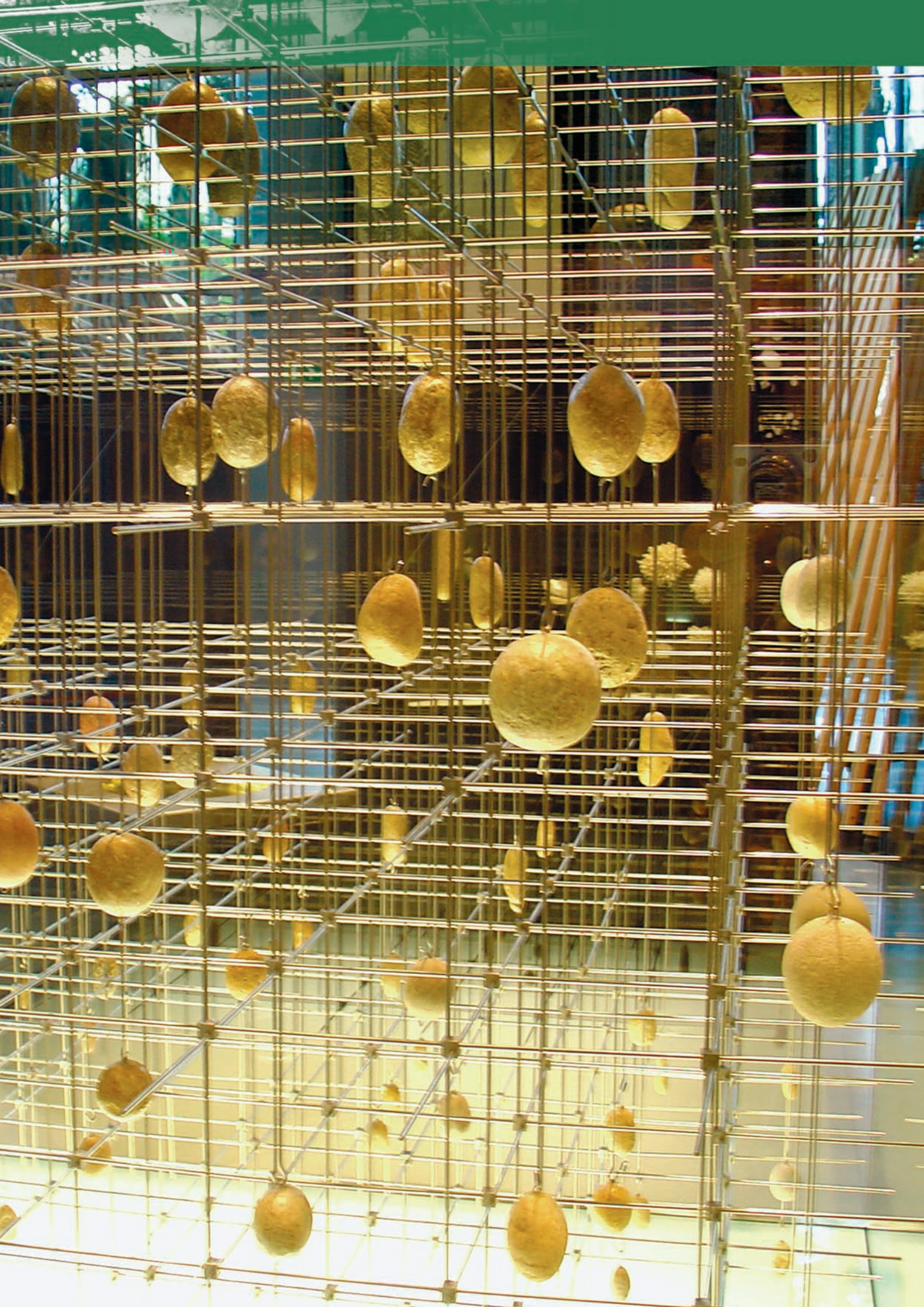
research, technology development and training work, by making quality contributions, and adding substantially to the science and technology effort by central government, and structuring the country's efforts in the sphere of research, development and innovation.

Knowledge generation is the basis of the vision of society forecast at the Lisbon and Barcelona summits. New knowledge is essential for innovation, which is the cornerstone of this model. However, the generation of new knowledge has unique characteristics which bring it into conflict with the rigid management procedures and limited independence of public bodies, above all when they take the form of autonomous bodies.

The CSIC provides its researchers with the basic resources they need for their work, but in general, it does not have its own funds from which to finance specific research tasks. Researchers must obtain the resources they need by taking part in calls for proposals, through which public funds are allocated on the basis of Europe-wide, national or regional competition. To a lesser extent they may also obtain funding from private sources. It is necessary to have specific management systems available that are rapid and flexible so as to allow support to be given to researchers so they are able to obtain these resources and implement their projects so they can do their professional work as scientists.

Undertaking research is a complex process. In general it is necessary to ensure that the necessary human resources, scientific and technical equipment, consumable material, etc. are all provided. These must be provided in a way that is sufficiently rapid to be able to optimise the results of the research. At the same time, research generally entails a high degree of risk or uncertainty, and this is that much greater the more important the challenge being faced. In the vast majority of cases it is necessary to modify the original approach over the course of a particular project. The CSIC's structure needs to be equipped with rapid mechanisms for managing the implementation of research and specific procedures to meet unexpected needs. Only thus will it be possible to make optimal use of resources and obtain the best possible results.

To this end it should be highlighted that the recent approval by the Senate of the bill for a Law Regulating State Agencies, the Additional Provision of which envisages the transformation of the CSIC into a State Agency, together with the announcement of a new regulation under the Subsidies Law and the modification of the Law on Public Contracts may be the structural solutions needed to overcome the management handicaps from which the CSIC currently suffers, particularly in terms of the management of its budget, economic and financial affairs, and personnel.



2 CURRENT SITUATION OF THE CSIC

The CSIC is today an autonomous public research body assigned to the Ministry of Education and Science, to which it reports through the State Secretariat for Universities and Research. It has a distinct legal identity, its own assets and finance, and is independently managed. It is governed according to the statute approved by Royal Decree 1945/2000, of 1 December 2000. This chapter gives a short summary of the current situation of the CSIC:

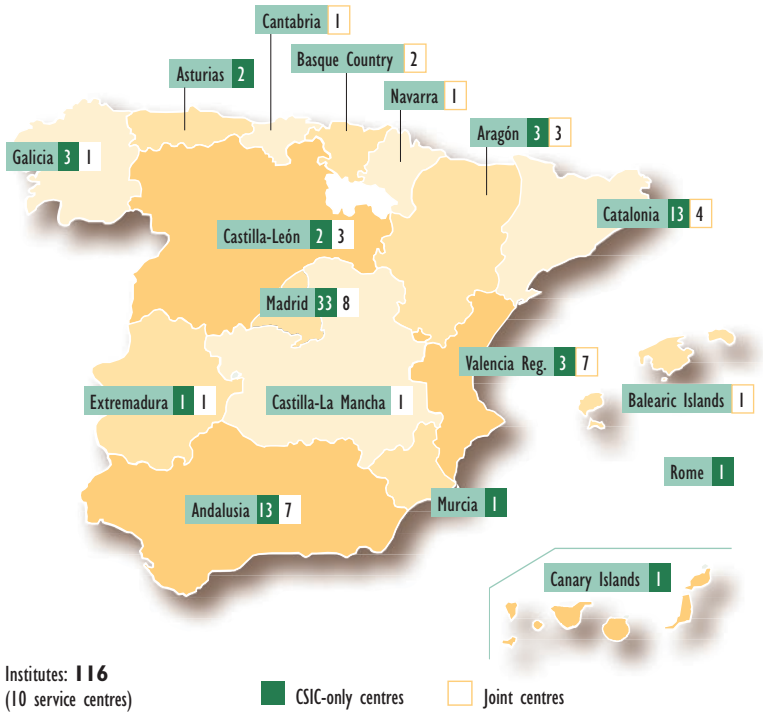
INTERNAL STRUCTURE

Organisation

The CSIC today consists of a network of 126 centres and institutes, of which 116 are research centres (76 are CSIC-only centres and 40 are joint centres with universities, Autonomous Regions or other bodies), 9 are service centres and 1 is a technical centre (Figure 2.1). The CSIC's centres are distributed throughout Spain, with the exception of the *Escuela Española de Historia y Arqueología de Roma* (Spanish School of Archaeology and History) in Rome, Italy.

FIGURE 2.1

THE CSIC'S NETWORK OF CENTRES AND INSTITUTES



This network of centres and institutes is backed up by a significant range of infrastructure, including experimental farms, research vessels, observatories, large installations and unique facilities, and the country's widest and most complete network of specialist libraries. To this should be added the more than 144 associated units made up of university groups and departments, hospitals and technology centres, working on projects and lines of research that are closely related to the CSIC.

The CSIC's centres and institutes carry out science and technology research in an autonomous and independent way. Each centre or institute has its own director, who is responsible for seeing that it is run efficiently and effectively. These centres and institutes are also organised into departments bringing together similar research groups working on related research topics. As well as research groups the operational research units include centres and institutes and operational units for management and organisation of the CSIC's activity.

The CSIC's centres and institutes are grouped into eight major scientific and technical areas according to the profile of the research they do. These scientific and technical areas are coordinated by the area coordinators, assisted in their coordination tasks by the area commission. The scientific and technical areas also have another body for debate in the form of the directors' senate, comprising the directors of all the area's centres and institutes. Table 2.1 shows the CSIC's current scientific and technical areas and the centres/institutes working in each. In some cases the lines of research carried out in a given centre or institute are such that it belongs to more than one scientific or technical area.

TABLE 2.1

SCIENTIFIC/TECHNICAL AREAS AND THE CSIC'S INSTITUTES AND CENTRES

Area 1: Humanities and Social Sciences	
Centro de Información y Documentación Científica (Scientific Information and Documentation Centre)	CINDOC
Escuela de Estudios Árabes (School of Arab Studies)	EEA
Escuela de Estudios Hispano-Americanos (School of Latin American Studies)	EEHA
Institución Milá y Fontanals (Milá y Fontanals Institution)	IMF
Instituto de Análisis Económico (Institute of Economic Analysis)	IAE
Instituto de Arqueología de Mérida (Merida Institute of Archaeology)	IAM
Instituto de Economía y Geografía (Institute of Economics and Geography)	IEG
Instituto de Estudios Gallegos Padre Sarmiento (Padre Sarmiento Institute of Galician Studies)	IEGPS
Instituto de Estudios Islámicos y Oriente Próximo (Institute of Islamic and Near Eastern Studies)	IEIOP
Instituto de Estudios Sociales Avanzados de Andalucía (Andalusian Institute of Advanced Social Studies)	IESAA

Instituto de Filología (Institute of Philology)	IFL
Instituto de Filosofía (Institute of Philosophy)	IFS
Instituto de Gestión de la Innovación y el Conocimiento (Institute of Innovation and Knowledge Management)	INGENIO
Instituto de Historia (Institute of History)	IH
Instituto de Historia de la Ciencia y Documentación López Piñero (López Piñero Institute of the History of Science and Documentation)	IHCD
Instituto de la Lengua Española (Spanish Language Institute)	ILE
Unidad de Políticas Comparadas (Comparative Policy Unit)	UPC
Escuela Española de Historia y Arqueología (Spanish School of History and Archaeology)	EEHA
Instituto Histórico Hoffmeyer (Hoffmeyer History Institute)	IHH

Area 2: Biology and Biomedicine	
Centro Andaluz de Biología del Desarrollo (Andalusian Centre for Development Biology)	CABD
Centro Andaluz de Biología Molecular y Medicina Regenerativa (Andalusian Centre for Molecular Biology and Regenerative Medicine)	CABIMER
Centro de Biología Molecular Severo Ochoa (Severo Ochoa Molecular Biology Centre)	CBMSO
Centro de Investigación Cardiovascular (Cardiovascular Research Centre)	CIC
Centro de Investigaciones Biológicas (Centre for Biological Research)	CIB
Centro Nacional de Biotecnología (National Biotechnology Centre)	CNB
Instituto Biología Molecular Eladio Viñuela (Eladio Viñuela Molecular Biology Institute)	IBMEV
Instituto de Biología Molecular de Barcelona (Barcelona Molecular Biology Institute)	IBMB
Instituto de Biología Molecular y Celular de Plantas Primo Yufera (Primo Yufera Molecular and Cellular Plant Biology Institute)	IBMCP
Instituto de Biología Molecular y Celular del Cáncer de Salamanca (Salamanca Molecular and Cellular Cancer Biology Institute)	IBMCC
Instituto de Biología y Genética Molecular (Molecular Biology and Genetics Institute)	IBGM
Instituto de Biomedicina de Valencia (Valencia Biomedicine Institute)	IBV
Instituto de Bioquímica Vegetal y Fotosíntesis (Plant Biochemistry and Photosynthesis Institute)	IBVF
Instituto de Farmacología y Toxicología (Pharmacology and Toxicology Institute)	IFTOX
Instituto de Investigaciones Biomédicas de Barcelona (Barcelona Biomedical Research Institute)	IIBB
Instituto de Investigaciones Biomédicas de Madrid Alberto Sols (Alberto Sols Biomedical Research Institute, Madrid)	IIBM
Instituto de Microbiología Bioquímica (Biochemical Microbiology Institute)	IMB
Instituto de Neurobiología Ramón y Cajal (Ramón y Cajal Neurobiology Institute)	INRC
Instituto de Neurociencias (Neurosciences Institute)	IN
Instituto de Parasitología y Biomedicina López Neyra (López Neyra Parasitology and Biomedicine Institute)	IPBLN
Unidad de Biofísica (Biophysics Unit)	UBF

Area 3: Natural Resources	
Centro de Estudios Avanzados de Blanes (Blanes Advanced Studies Centre)	CEAB
Centro de Investigación sobre Desertificación (Centre for Research into Desertification)	CIDE
Centro Edafología y Biología Aplicada del Segura (Segura Pedology and Applied Biology Centre)	CEBAS
Estación Biológica de Doñana (Doñana Biological Station)	EBD
Estación Experimental de Zonas Áridas (Arid Zones Experimental Station)	EEZA
Estación Experimental de El Zaidín (El Zaidín Experimental Station)	EEZ
Instituto Andaluz de Ciencias de la Tierra (Andalusian Earth Sciences Institute)	IACT
Instituto Botánico de Barcelona (Barcelona Botanical Institute)	IBB
Instituto de Acuicultura Torre de la Sal (Torre de la Sal Aquaculture Institute)	IATS

Instituto de Agroquímica y Tecnología de Alimentos (Agrochemicals and Food Technology Institute)	IATA
Instituto de Astronomía y Geodesia (Astronomy and Geodesy Institute)	IAG
Instituto de Ciencias de la Tierra Jaume Almera (Jaume Almera Earth Sciences Institute)	ICTJA
Instituto de Ciencias del Mar (Marine Sciences Institute)	ICM
Instituto de Ciencias Marinas de Andalucía (Andalusia Marine Sciences Institute)	ICMAN
Instituto de Geología Económica (Economic Geology Institute)	IGE
Instituto de Investigación en Recursos Cinegéticos (Hunting Resources Research Institute)	IREC
Instituto de Investigaciones Marinas (Marine Research Institute)	IIM
Instituto de Productos Naturales y Agrobiología (Natural Produce and Agrobiology Institute)	IPNA
Instituto de Recursos Naturales (Natural Resources Institute)	IRN
Instituto de Recursos Naturales y Agrobiología de Salamanca (Salamanca Natural Resources and Agrobiology Institute)	IRNASA
Instituto de Recursos Naturales y Agrobiología de Sevilla (Seville Natural Resources and Agrobiology Institute)	IRNAS
Instituto Mediterráneo de Estudios Avanzados (Mediterranean Institute for Advanced Studies)	IMEDEA
Instituto Pirenáico de Ecología (Pyrenean Ecology Institute)	IPE
Museo Nacional de Ciencias Naturales (National Natural Science Museum)	MNCN
Real Jardín Botánico (Royal Botanical Garden)	RJB
Unidad de Tecnología Marina (Marine Technology Unit)	UTM

Area 4: Agricultural Sciences	
Centro Edafología y Biología Aplicada del Segura (Segura Pedology and Applied Biology Centre)	CEBAS
Estación Agrícola Experimental de León (León Experimental Agriculture Station)	EAE
Estación Experimental Aula Dei (Aula Dei Experimental Station)	EEAD
Estación Experimental de El Zaidín (El Zaidín Experimental Station)	EEZ
Estación Experimental La Mayora (La Mayora Experimental Station)	EELM
Instituto de Agricultura Sostenible (Sustainable Agriculture Institute)	IAS
Instituto de Agrobiotecnología y Recursos Naturales (Agrobiotechnology and Natural Resources Institute)	IARN
Instituto de Agroquímica y Tecnología de Alimentos (Agrochemicals and Food Technology Institute)	IATA
Instituto de Ciencias Agrarias (Agricultural Sciences Institute)	ICA
Instituto de Investigaciones Agrobiológicas de Galicia (Galicia Agrobiological Research Institute)	IIAG
Instituto de Productos Naturales y Agrobiología (Natural Produce and Agrobiology Institute)	IPNA
Instituto de Recursos Naturales y Agrobiología de Salamanca (Salamanca Natural Resources and Agrobiology Institute)	IRNASA
Instituto de Recursos Naturales y Agrobiología de Sevilla (Seville Natural Resources and Agrobiology Institute)	IRNAS
Misión Biológica de Galicia (Galicia Biological Mission)	MBG

Area 5: Physical Sciences and Technology	
Centro de Astrobiología (Astrobiology Centre)	CAB
Instituto de Acústica (Acoustics Institute)	IA
Instituto de Astrofísica de Andalucía (Andalusia Astrophysics Institute)	IAA
Instituto de Astronomía y Geodesia (Astronomy and Geodesy Institute)	IAG
Instituto de Automática Industrial (Industrial Automation Institute)	IAI
Instituto de Ciencias del Espacio (Space Sciences Institute)	ICE
Instituto de Estructura de la Materia (Materials Structure Institute)	IEM
Instituto de Física Aplicada (Applied Physics Institute)	IFA

Instituto de Física Corpuscular (Particle Physics Institute)	IFIC
Instituto de Física de Cantabria (Cantabria Physics Institute)	IFCA
Instituto de Física Teórica (Theoretical Physics Institute)	IFTE
Instituto de Investigación en Inteligencia Artificial (Artificial Intelligence Research Institute)	IIIA
Instituto de Matemáticas y Física Fundamental (Institute of Mathematics and Fundamental Physics)	IMAFF
Instituto de Microelectrónica de Barcelona (Barcelona Microelectronics Institute)	CNM-IMB
Instituto de Microelectrónica de Madrid (Madrid Microelectronics Institute)	CNM-IMM
Instituto de Microelectrónica de Sevilla (Seville Microelectronics Institute)	CNM-IMS
Instituto de Óptica Daza de Valdés (Daza de Valdés Optics Institute)	IO
Instituto de Robótica e Informática Industrial (Institute of Robotics and Industrial Computing)	IRII
Instituto Mediterráneo de Estudios Avanzados (Mediterranean Institute for Advanced Studies)	IMEDEA
Observatorio de Física Cósmica del Ebro (Ebro Cosmic Physics Observatory)	OE

Area 6: Materials Sciences and Technology	
Centro Nacional de Investigaciones Metalúrgicas (National Centre for Metallurgy Research)	CENIM
Instituto de Cerámica y Vidrio (Glass and Ceramics Institute)	ICV
Instituto de Ciencia de Materiales Barcelona (Barcelona Materials Sciences Institute)	ICMAB
Instituto de Ciencia de Materiales de Aragón (Aragón Materials Sciences Institute)	ICMA
Instituto de Ciencia de Materiales de Madrid (Madrid Materials Sciences Institute)	ICMM
Instituto de Ciencia de Materiales de Sevilla (Seville Materials Sciences Institute)	ICMS
Instituto de Ciencia y Tecnología de Polímeros (Polymer Science and Technology Institute)	ICTP
Instituto Eduardo Torroja de Ciencias de la Construcción (Eduardo Torroja Institute of Construction Sciences)	IETCC
Unidad de Física de Materiales (Materials Physics Unit)	UFM

Area 7: Food Sciences and Technology	
Centro Edafología y Biología Aplicada del Segura (Segura Pedology and Applied Biology Centre)	CEBAS
Instituto de Agroquímica y Tecnología de Alimentos (Agrochemicals and Food Technology Institute)	IATA
Instituto de Fermentaciones Industriales (Industrial Fermentation Institute)	IFI
Instituto de Investigaciones Marinas (Marine Research Institute)	IIM
Instituto de la Grasa (Fats Institute)	IG
Instituto de Productos Lácteos de Asturias (Asturias Dairy Products Institute)	IPLA
Instituto del Frío (Institute of Refrigeration)	IF

Area 8: Chemical Sciences and Technology	
Instituto de Carboquímica (Carbon chemistry Institute)	ICB
Instituto de Catálisis y Petroleoquímica (Catalysis and Petrochemicals Institute)	ICP
Instituto de Ciencia de Materiales de Aragón (Aragón Materials Sciences Institute)	ICMA
Instituto de Investigaciones Químicas (Chemistry Research Institute)	IIQ
Instituto de Investigaciones Químicas y Ambientales de Barcelona Pascual Vila (Pascual Vila Chemistry and Environmental Research Institute, Barcelona)	IIQAB
Instituto de Productos Naturales y Agrobiología (Natural Produce and Agrobiology Institute)	IPNA
Instituto de Química Física Rocasolano (Rocasolano Physical Chemistry Institute)	IQFR
Instituto de Química Médica (Medical Chemistry Institute)	IQM
Instituto de Química Orgánica General (General Organic Chemistry Institute)	IQOG

Instituto de Tecnología Química (Chemical Technology Institute)	ITQ
Instituto Nacional del Carbón (National Coal Institute)	INCAR
Laboratorio de Investigación en Tecnología de la Combustión (Combustion Technology Research Laboratory)	LITEC

Service Centres and Management Structures	
Centro de Ciencias Medioambientales (Environmental Sciences Centre)	CCMA
Centro de Física Miguel Antonio Catalán (Miguel Antonio Catalán Physics Centre)	CFMAC
Centro de Humanidades (Humanities Centre)	CH
Centro de Investigación y Desarrollo (Research and Development Centre)	CID
Centro de Investigaciones Científicas Isla de la Cartuja (Isla de la Cartuja Scientific Research Centre)	CICIC
Centro de Química Orgánica Lora Tamayo (Lora Tamayo Organic Chemistry Centre)	CENQUIOR
Centro de Tecnologías Físicas Leonardo Torres Quevedo (Leonardo Torres Quevedo Physical Technology Centre)	CETEF
Centro Mediterráneo de Investigaciones Marinas y Ambientales (Mediterranean Centre for Marine and Environmental Research)	CMIMA
Centro Nacional de Aceleradores (National Accelerators Centre)	CNA
Centro Nacional de Microelectrónica (National Microelectronics Centre)	CNM
Centro Técnico de Informática (Information Technology Technical Centre)	CTI

TABLE 2.2

RESEARCH LINES OF THE CSIC'S VARIOUS SCIENTIFIC AND TECHNICAL AREAS

Area 1: Humanities and Social Sciences
Archaeology of the landscape, archaeometry and ethnoarchaeology
Bibliometrics and cybermetrics of science and technology
Social and cultural change. Cultural heritage and the Humanities
Science, culture and society
Environmental, rural and urban economics
Editing and study of Greek and Latin texts
Spanish today and its linguistic variations
Hebrew, Sephardic and Arab studies
International and development studies. Globalisation.
Social and philosophical studies of the sciences and technologies
Moral Philosophy
Knowledge Management. Evaluation of scientific activity
History of literary production, the book and reading in the Hispanic context
Population movements and inter-ethnic relations
Comparative politics
International relations in the configuration of the modern and contemporary world
Theory of literature, the theatre and the media. Literary criticism.

Area 2: Biology and Biomedicine
Biotechnology of plants and microorganisms
Cell cycle, development and differentiation
Structure and design of macromolecules
Pharmacology
Genetics and Molecular Biology of model organisms
Genetics and Physiopathology of human disease
Genomes, gene regulation and signal transduction
Immunology
Neurobiology and Neuropathology
Parasitology and Virology

Area 3: Natural Resources
Aquaculture
Biodiversity. Systematics, biogeography and evolution
Biology and physiology of organisms
Conservation and management of natural resources
Population ecology, communities and evolution
Ecosystems and macroecology
Structure and dynamics of the solid Earth
External geodynamics
Environment and environmental impacts
Oceanography and coastal systems

Area 4: Agricultural Sciences
Water in agriculture
Soil conservation, quality and organic matter
Contamination of soils and soil recuperation
Agricultural entomology and weed science
Environmental stress
Phytopathology: viruses, fungi and nematodes
Photosynthesis
Forestry and fruit growing
Stock rearing
Beneficial plant-microorganism interactions
Genetic improvement
Vegetable nutrition

Area 5: Physical Sciences and Technologies
Acoustics and ultrasound
Astrophysics
Physics and Electronic Engineering
Distributed computing
Cosmology and gravitation
Particle physics
Experimental physics
Theoretical and mathematical physics
Quantum information and cryptology
Artificial intelligence
Fundamental and applied mathematics
Micro and nano-systems
Optics
Robotics

Area 6: Materials Sciences and Technology
Technological support and historical heritage activities
Functional Materials and Nanomaterials
Materials for Health and the Environment
Materials for high Industrial Production sectors
New Materials Processing Methods
Theory and Structure of Matter

Area 7: Food Sciences and Technology
Physical, chemical and biochemical basis of quality
Bioavailability and risk/benefit ratio of food nutrients
Biotechnology of edible vegetables and microorganisms of nutritional interest
Development of new bioactive products and packaging
Immunonutrition and nutrogenomics
Lipid metabolism
Analytic methodology for the characterisation, traceability and safety of foods
Modelling and optimisation of traditional processes and new processing technologies
Obtaining functional foods and ingredients

Area 8: Chemical Sciences and Technology
Catalysis and chemical processes
Energy and energy resources
Fundamentals and applications of chemistry techniques and instrumentation
Biological chemistry and medical chemistry
Chemistry of materials and nanotechnology
Physical chemistry in interfaces
Molecular physical chemistry
Organometallic chemistry and coordination compounds
Environmental chemistry and technology
Organic synthesis

The range of research undertaken at the CSIC's centres and institutes is extremely wide, taking in almost all areas of knowledge covered at universities (See table 4.3 in Chapter 4). Table 2.2 summarises the main lines of research that are currently being pursued at the CSIC's various scientific and technical areas.

In addition to its centres and institutes the CSIC runs a series of singular installations and large facilities permitting its researchers to carry out research that would not otherwise be possible. These include the Doñana Biological Station (*Reserva-Estación Biológica de Doñana,* Seville-Huelva), which is of huge interest for studies of its ecology and biodiversity, the Saharan Fauna Rescue Park in the Arid Zones Experimental Station (*Parque de Rescate de la Fauna Sahariana de la*

The CSIC, as the largest Spanish institution exclusively dedicated to research, promotes and performs scientific research of excellence in multiple domains of knowledge. It encourages technology transfer to the productive sector, trains new researchers and bolsters and communicates scientific culture to society.

Estación Experimental de Zonas Áridas, Almería), the Royal Botanical Gardens (*Real Jardín Botánico*) and the National Museum of the Natural Sciences (*Museo Nacional de Ciencias Naturales*) in Madrid, whose collections of flora and fauna are some of the most important in Europe, and the Sierra Nevada Observatory, etc. The CSIC also has a number of buildings of considerable historical interest, such as the Casa del Chapiz at the School of Arab Studies (Granada), the *Institución Milá i Fontanals* (Barcelona), the *Residencia de Estudiantes* (Madrid), and the Galicia Biological Mission (Pontevedra), among others.

The Large-Scale Scientific Facilities managed by the CSIC deserve special mention. Each year these welcome visits from a large number of researchers from both Spain and abroad, who use these facilities to carry out research that would be impossible without them. In 2005 the CSIC managed the following Large-Scale Scientific Facilities: Juan Carlos I Spanish Antarctic Station on Livingstone Island; the Spanish Navy's Hespérides Oceanographic Research Vessel; the Sarmiento de Gamboa Oceanographic Research Vessel, which was launched in January 2006 and is currently being fitted out with latest generation scientific and nautical equipment; the white room at the *Instituto de Microelectrónica de Barcelona* (Barcelona Microelectronics Institute); the Calar Alto Astronomical Centre, in Sierra de los Filabres, Almería, which is managed jointly by the CSIC's *Instituto de Astrofísica de Andalucía* (Andalusia Astrophysics Institute, Granada) and the *Institut für Astronomie* in Heidelberg (Max Plank Gesellschaft. Germany), and which is home to the largest astronomical telescopes in mainland Spain. The CSIC also manages the Spanish part of two large-scale European facilities, namely the European Synchrotron Radiation Laboratory and the Max von Laue-Paul Langevin Institute, both of which are in Grenoble (France) and are, respectively, the most powerful synchrotron radiation source in Europe and the world's most intense source of neutrons. Both are important for ultra-structural studies of matter.

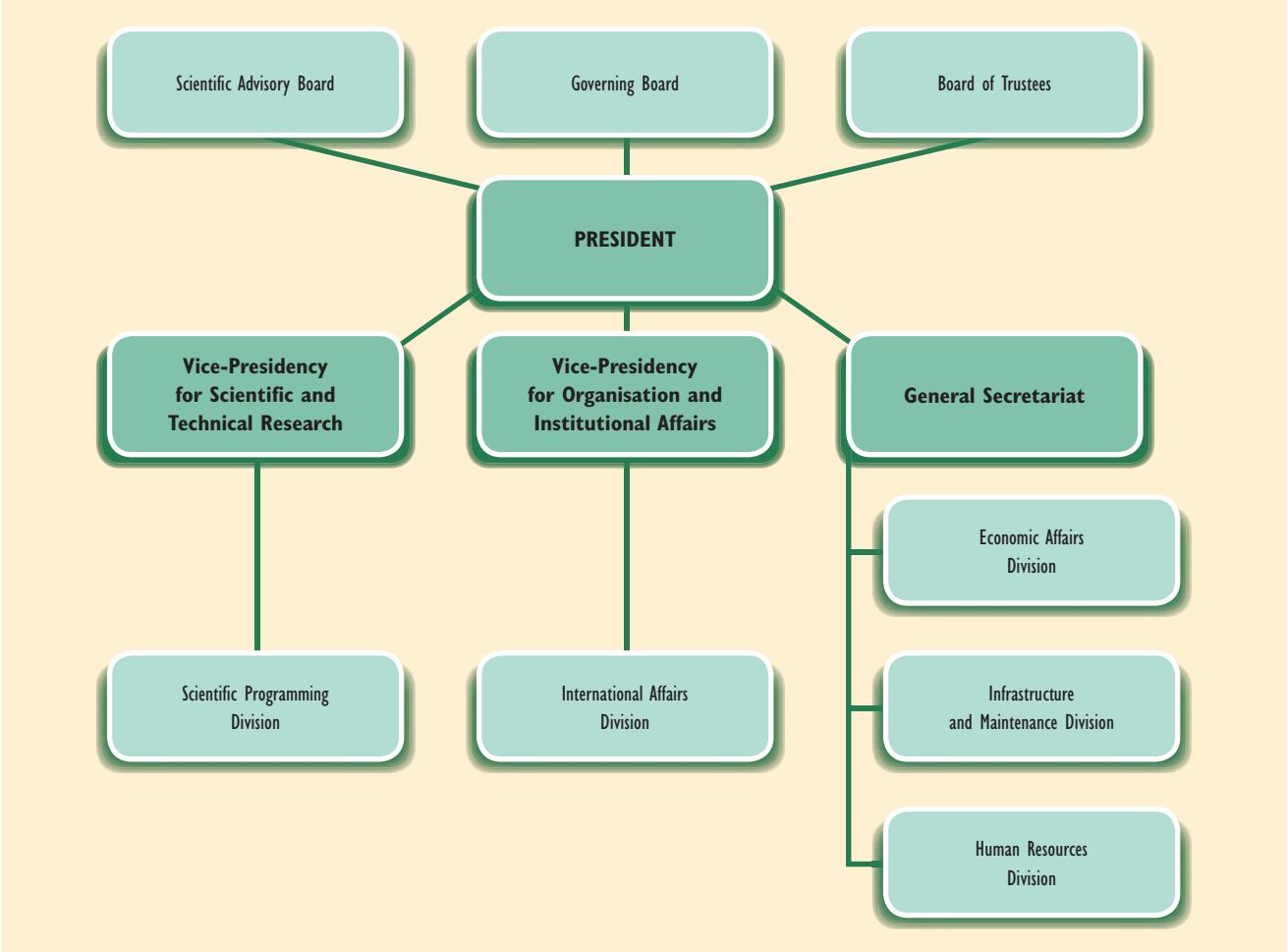
Lastly, the CSIC runs Spain's largest network of libraries. This network is coordinated by the Libraries Coordination Unit. In 2005 it delivered a total of 4,406,570 pages, in response to 1,407,193 enquiries, of which a significant volume come from centres and institutions outside the CSIC.

Governing Bodies

The President of the CSIC has ultimate responsibility for the institution. Hierarchically, the President of the CSIC reports to the State Secretary for Universities and Research within the Ministry of Education and Science. There are also a number of other govern-

ing bodies involved in the CSIC's governance: the Scientific Advisory Board (*Comité Científico Asesor*), the Governing Board (*Junta de Gobierno*) and the Board of Trustees (*Consejo Rector*). The institution is managed by a series of hierarchically structured departments. At the topmost level, below the Presidency, is the Vice-Presidency for Scientific and Technical Research (*Vicepresidencia de Investigación Científica y Técnica*, VICYT), the Vice-Presidency for Organisation and Institutional Affairs (*Vicepresidencia de Organización y Relaciones Institucionales,* VORI) and the General Secretariat (*Secretaría General*, SEGE). Beneath the general secretariat and each of the vice-presidencies there are a number of divisions, which are responsible for various different aspects of the management of the institution, as shown in the structure chart in figure 2.2. The CSIC's management also has a number of advisory bodies (advisors to the president).

FIGURE 2.2
MANAGEMENT STRUCTURE OF THE CSIC



At the start of 2006 the CSIC had more than 1,455 agreements in effect with other national (1,319) and foreign (136) institutions.

The Vice-Presidency for Scientific and Technical Research (VICYT) is responsible for the CSIC's scientific and technical coordination, through the Scientific Programming Division (*Subdirección General de Programación, Seguimiento y Documentación Científica*, SGPSDC). The scientific and technical areas referred to above are central to this coordination within the Scientific Programming Division. The committees for each area are responsible for defining the general guidelines for the research carried out at the centres and institutes. In effect, the coordinators and area committees are responsible for distributing and defining the profiles for the research places offered, grants and contracts for the CSIC's scientific personnel recruited through open competitions, selecting and approving research projects financed from the institution's in-house funds, supervising and approving the strategic plans of its centres and institutes and assigning the human and economic resources linked to them, etc.

This division is also responsible for all issues relating to the management of nationally funded research projects, research funded from the CSIC's own budget, and for organising offers of employment for permanent or temporary scientific staff. The Technology Transfer Office (*Oficina de Transferencia de Tecnología*, OTT) and the Postgraduate and Specialisation Department (*Departamento de Postgrado y Especialización*, DPE) also report to the Scientific Programming Division. The OTT is responsible for commercially exploiting the research done by the CSIC, either through patents, licence agreements with companies, or by supporting the creation of technology-based companies in the form of spin-offs or start-ups. The DPE manages the whole range of issues relating to the training of researchers at pre-doctoral level and organising masters' degrees and post-graduate and specialisation courses.

The Vice-Presidency for Organisation and Institutional Affairs (VORI) is responsible for the organisation of the CSIC's centres and institutes and relations with other national and international institutions. The Vice-Presidency manages all international matters through the International Affairs Division (SGRI), including both relations with other European institutions and research funding obtained from international funding sources. In the various Autonomous Regions in which the CSIC has centres or institutes, the CSIC's management is represented by institutional delegates reporting to the VORI. The role of these institutional delegates is to carry out certain functions of president which are delegated to them.

The CSIC's General Secretariat (SEGE) is responsible for all the institution's administrative management matters. It has three divi-

sions reporting to it: the Financial Affairs Division, the Infrastructure and Maintenance division and the Human Resources Division. The Financial Affairs Division manages all aspects of the execution of the budget and other issues of a financial nature. The Infrastructure and Maintenance Division is responsible for managing all the institution's major purchases, such as work to build or remodel centres or institutes or other large-scale facilities (such as oceanographic vessels, experimental farms, observatories, etc.) Personnel and social action issues are the responsibility of the Human Resources Division, which is also in charge of the staff training plan, which is run by the Training Bureau, health and safety at work, which is dealt with by the Occupational Risks Prevention Department.

The management of the CSIC also has a number of Support Units, with forums for information and debate with the directors (Directors' Conference) and managers (Managers' Seminars) of the CSIC's centres and institutes, which help to define the scientific and administrative guidelines for the institution.

The Managers' Seminars, which are coordinated by the General Secretary and organised by the Managers' Standing Committee (the most recent seminar being the 7th managers' meeting, entitled «manage well to research better», which was held in Palma de Mallorca in May 2005) is a forum for debate which brings together the managers of the 116 CSIC institutes and the various governing bodies, with the aim of analysing management problems faced by the institution and proposing solutions.

The recently created Directors' Conference, which held its first meeting in September 2005, has as its main goal that of advising the president on various issues relating to the scientific management of the institutes and centres. The first meeting of the Directors' Conference was devoted to discussing the preparation of the current CSIC Action Plan for 2006-2009, covering topics such as the position of the CSIC in the Spanish and European research systems; the CSIC's response to new R&D challenges; and knowledge transfer to the productive sector and society as a whole. As in the case of the Managers' Seminars, the content of the Directors' Conference is prepared by an ad hoc Directors' Committee (*Comisión de Directores*, CODIR), which represents the directors of all eight of the CSIC's scientific and technical areas.

Lastly, the CSIC has a Women and Science Committee, whose function is specifically to examine gender-related issues in the institution, and the Bioethics Committee, which advises the President on any bioethics aspects of the CSIC's research.

Human Resources

The CSIC's human resources are classed as research staff, technicians, management staff, and maintenance personnel. While the CSIC's research staff are the people directly responsible for doing the work that comprises the CSIC's mission, that is to say, undertaking top quality scientific and technical research and training high quality researchers, all the institution's other staff also play a role in fulfilling the CSIC's mission. Indeed, an institution of the size and complexity of the CSIC could not function without the contribution of all categories of staff.

In 2005 a total of 12,479 people worked for the institution, of whom 3,202 were scientists, 3,806 research fellows and a further 5,471 were made up of research technicians, administrative staff and maintenance personnel. The CSIC's staff is subdivided into public servants (4,864), contract personnel (3,809) and research fellows (3,806). Contract personnel are further subdivided into permanent (858) and temporary (2,951) staff. Figure 2.3 shows the distribution of the CSIC's staff in 2005 by function.

Contract scientists include scientists contracted under the Ramón y Cajal Programme. Under this programme the CSIC formalised 50 contracts in 2005, bringing the total number of contracts signed since the programme began in 2001 to 652. This figure represents 26% of all the contracts of this kind granted by the Ministry of Education and Science. It should be noted that a large percentage of these researchers recently joined the CSIC's workforce as tenured scientists.

FIGURE 2.3

DISTRIBUTION OF THE CSIC'S HUMAN RESOURCES IN 2005

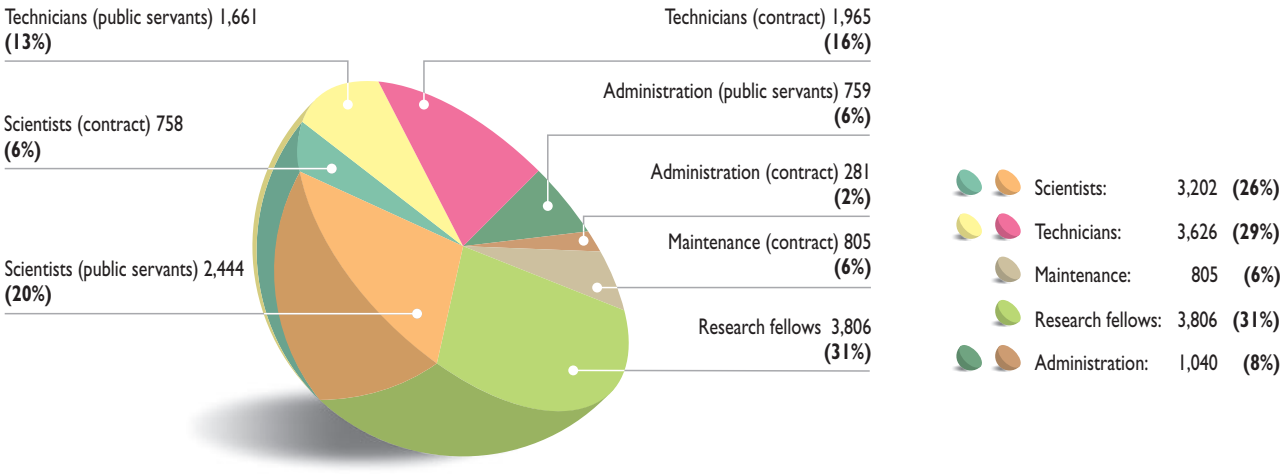


Figure 2.4 shows the distribution of scientists employed as public servants by Scientific-Technical Area. Figure 2.5 shows their distribution by sex and scale.

Financial Resources

The CSIC is a public research organisation (PRO) and as such reports directly to the Ministry of Education and Science. The CSIC's activities are funded in two ways. On the one hand, the Ministry of Education and Science assigns it an annual operating budget. And on the other, the CSIC's researchers need to submit proposals to public calls for proposals for research funding at national, regional, local and international level in order to obtain funding with which to run their research projects. Other sources of funding for the CSIC's activities include research contracts with either the public or private sector, and royalties from the licensing of patents it owns. In 2005 the CSIC's ordinary budget from the national government was €412.21 million. The distribution of this budget across the various chapters is shown in table 2.3.

In this same year the CSIC obtained income through commercial operations of €196.14 million from external sources. Thus, its total budget in 2005 came to €605.35 million.

The CSIC's external funding derives, at national level, to a large extent from the National R&D Plan (*Plan Nacional de I+D*) and from special projects and actions. To a lesser extent, funding is also obtained from calls for proposals run by the Autonomous Regions.

TABLE 2.3

CSIC BUDGET FROM NATIONAL GOVERNMENT IN 2005

Chapter	Definitive budget
I	267,444,010
II	37,908,200
III	330
IV	2,256,680
VI	92,774,790
VII	11,180,590
VIII	644,890
Total	**412,209,490**

FIGURE 2.4

DISTRIBUTION OF SCIENTISTS EMPLOYED AS PUBLIC SERVANTS BY SCIENTIFIC/TECHNICAL AREAS

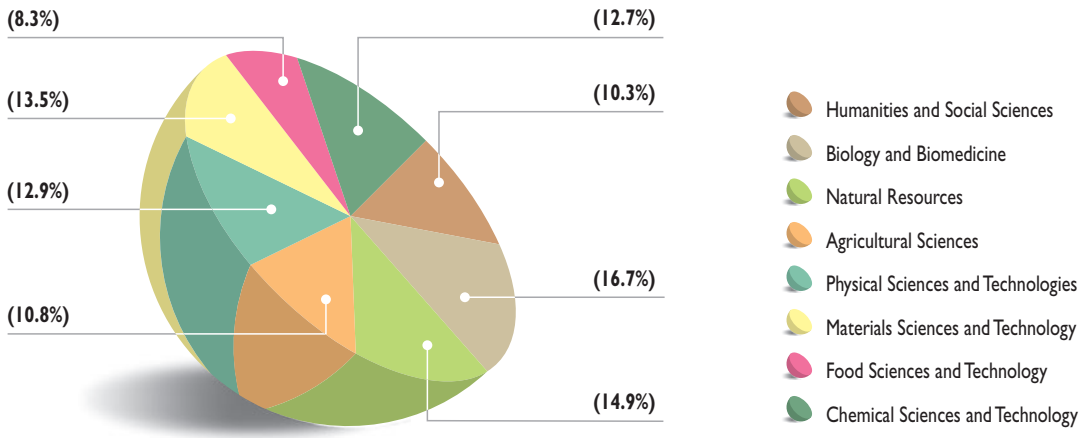
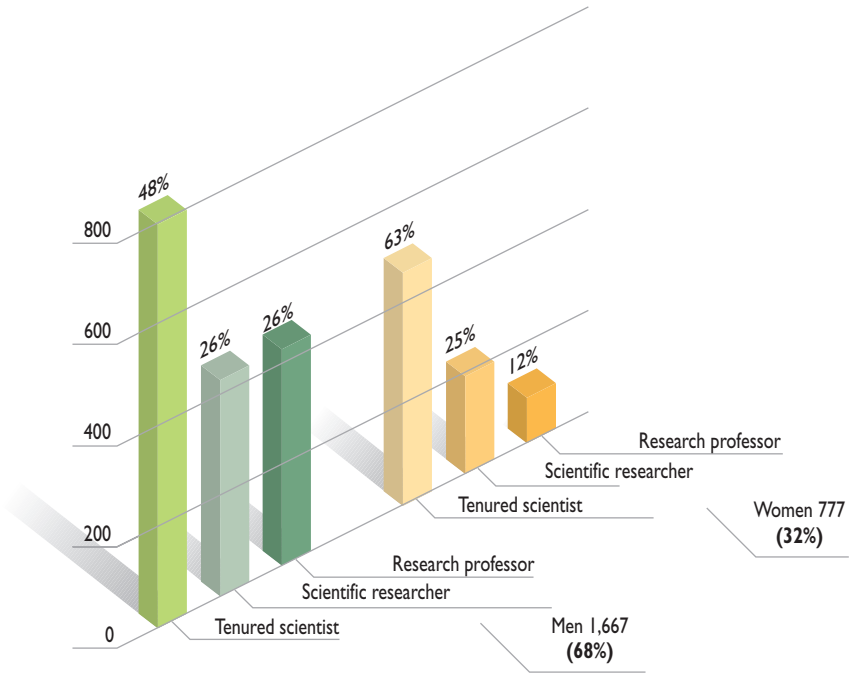


FIGURE 2.5

DISTRIBUTION OF SCIENTIFIC PERSONNEL EMPLOYED AS PUBLIC SERVANTS BY SEX AND GRADE



Thus, in 2005 the CSIC managed to obtain a total of €87.41 million for research projects from national funds. Another important source of research funding for the CSIC is the European Union's Framework Programmes. In 2005 the CSIC had 450 contracts in force, corresponding to this number of research projects under the Fifth and Sixth Framework Programmes (172 contracts under FP5 and 185 contracts under FP6), the Marie Curie Programme (64 actions) and other actions (29 projects). In total these actions provided €93.5 million in European funds for research. Lastly, another important source of funding for the CSIC's research activity comes from contracts with companies and the public sector. In 2005 contracts of this kind brought in a further €41.92 million through 1,143 contracts and agreements.

SCIENCE AND TECHNOLOGY ACTIVITY

Scientific Output

The CSIC is Spain's leading organisation in terms of its output of scientific publications. In 2005 the CSIC published a total of near-

ly 8,800 publications, including books and papers in journals. Of these, around 5,444 were articles published in journals indexed by the Institute for Scientific Information (ISI) in Philadelphia. This output accounts for almost 20% of the Spanish scientific publications included in the ISI databases, and is equal to 0.6% of world output.

The CSIC is also the leading Spanish entity in the Patent Cooperation Treaty ranking of patent holders, which is something of an anomaly, as in all other OECD countries major companies are further up the rankings than public research organisations. In 2005 the CSIC registered 109 new Spanish patents and 64 international patents. Additionally, more than 20 patents were licensed to companies for their exploitation. Despite this prominent position, however, income from the exploitation of licensed patents brings in only slightly more than two million euros a year. At present the CSIC has almost 700 contracts with companies (of which 76 are international), generating 22 million euros a year. Also, CSIC researchers generated 10 new spin-off companies in 2005.

From the above it may be concluded that the CSIC is a highly competitive organisation on the international scene and highly profitable nationally, as with a small percentage of expenditure and personnel it produces science and technology results that are above the level its current economic and management resources would suggest.

In 2005 the CSIC's researchers published almost 8,800 publications, including articles in journals and books; 5,444 of the journals in which they published were indexed by the ISI (approximately 20% of Spanish scientific publications and 0.6% of worldwide output); they registered 109 new national patents and 64 international ones; over 20 patents were licensed; close to 700 contracts with companies were in effect (76 of which were international); and 10 new spin-off companies were created.

Internally funded (in-house) research

In recent years there has been an increasing budgetary allocation to the CSIC's in-house programmes. The most significant projects of this kind are the frontier in-house projects (*proyectos intramurales frontera*, PIF). The aim of this programme is to allow the CSIC's scientists to make in-roads into new topics, resulting from the interaction of various areas of knowledge, by funding pre-competitive projects from the institution's own funds. The innovative nature of these projects means that they do not fit in to the priority lines of the public calls for research project proposals. The programme aims to promote interdisciplinarity, and requires that the teams proposing projects for funding include research groups from at least two of the CSIC's scientific and technical areas. There must also be collaboration between groups in these projects, so that at least three groups must be participating in the project. Table 2.4 summarises the results of the PIF calls for proposals in 2004 and 2005.

TABLE 2.4

PIF CALLS FOR PROPOSALS 2004 AND 2005

	2004	2005
Expressions of interest	102	73
Confirmed projects	17	27
Approved projects	16	24
Total funding	€1,2M	€3,1M

Participation in the National R&D and innovation Plan

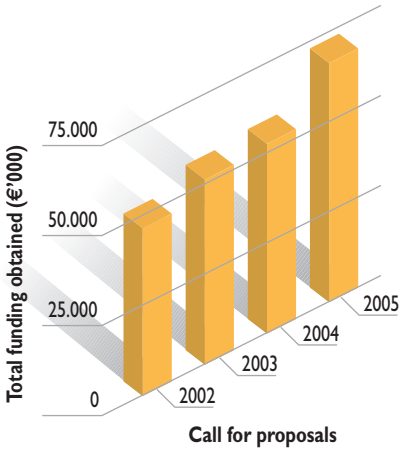
The CSIC is one of the most important clients of the National Plan, capturing around 20% of the total funding assigned to research projects under the plan. The CSIC's participation in the Nation Plan in recent years has shown a progressive increase in the resources obtained through the various calls for proposals (Figure 2.6).

As the figure shows, in 2002 the total funding obtained was slightly less than €50 million, compared to €70 million in 2005. This represents an increase of 40%, which has been absorbed without increasing the CSIC's workforce over this period, which demonstrates the potential and quality of the CSIC's scientists. Evidence of this potential and quality is also given by their success rate in obtaining projects under the National Plan (74%).

Figure 2.7 shows the funding acquired by the CSIC from the various national programmes as a percentage of the total available from each. As the figure shows, in the majority of these programmes the CSIC's researchers obtained more than 10% of the total, with the exception of the programmes dealing with Information and Communications Technology, Social Sciences, Economics, Jurisprudence, Mathematics, Industrial Design and Production, and Means of Transport, these all being areas traditionally linked to the universities. The Biotechnology (41.6%); Fundamental Biology (31.6%); Agrofoods Resources and Technologies (28.2%); Materials (26.6%); Biomedicine (26.0%); Biodiversity, Earth Sciences and Global Change (25.6%), Environmental Sciences and Technologies (21.8%); Space (20%) areas all stand out. These results are particularly significant bearing in mind that the CSIC accounts for just 6% of the human resources devoted to R&D in Spain.

FIGURE 2.6

PARTICIPATION OF THE CSIC IN THE NATIONAL R&D PLAN 2002 - 2005

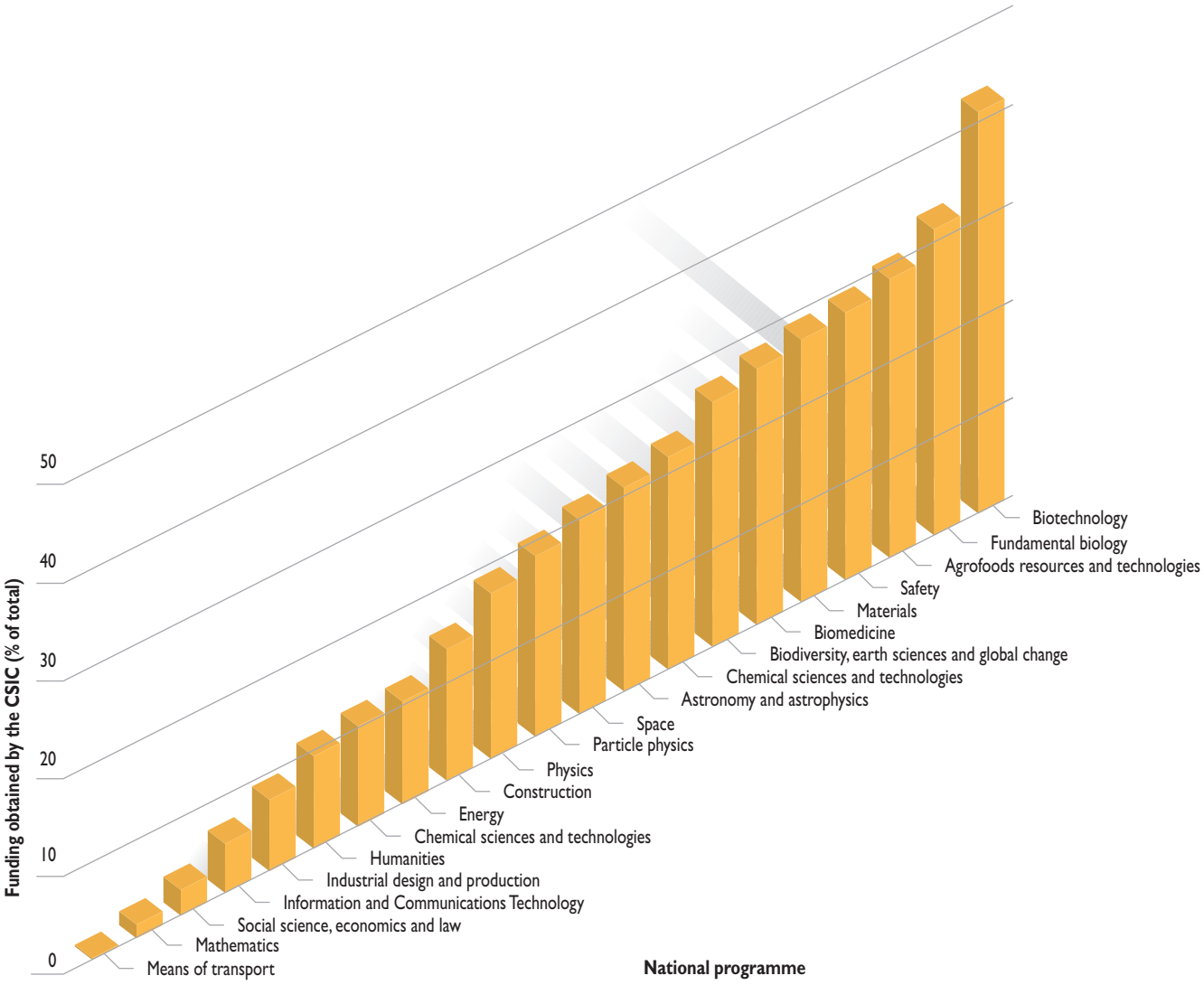


Participation in European Union Framework Programmes

The CSIC is a major participant in European Programmes (Fig. 2.8). The total number of contracts signed under the 5th Framework Programme (FP5) was 789, for which the total funding was €92.5m. In the 6th Framework Programme the CSIC took part in 357 projects (33 of which it coordinated), for which there was a total funding of €79.9m. This is equal to slightly more than 11% of the national total.

FIGURE 2.7

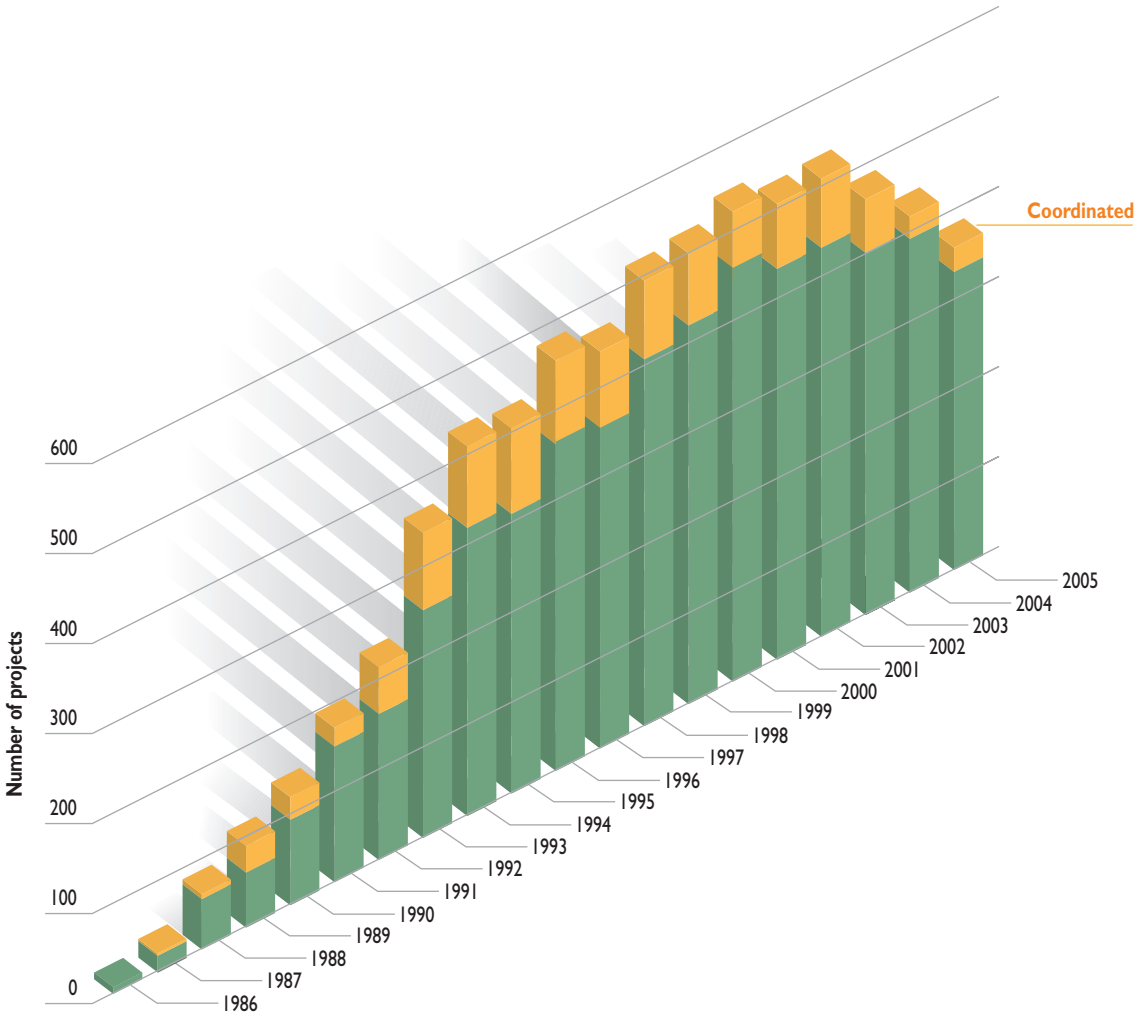
PERCENTAGE FUNDING FROM NATIONAL PROGRAMMES OBTAINED BY THE CSIC



Outside the Framework Programme the CSIC was involved in a total of 63 European projects, with total funding of €9.2m. Particularly noteworthy is its involvement in the ECSC Programme (European Coal and Steel Community), under which there were 38 projects underway in 2002, for which the funding was €6.7m. The CSIC also had contracts and projects in the framework of COST, EUMEDIS, LEONARDO, SOCRATES, European Environmental Agency, ERA, and others.

FIGURE 2.8

PARTICIPATION OF THE CSIC IN THE EU'S FRAMEWORK PROGRAMMES



Participation in other International Programmes

The CSIC currently has scientific and technical cooperation links with 38 bodies in 27 countries in Western Europe, Eastern Europe and Latin America, as well as in Canada, China, Korea, Japan and Egypt. In 2005, within the framework of the CSIC's agreements with institutions in these countries, 303 joint research projects were funded, 401 Spanish researchers were able to take advantage of the opportunity to visit foreign research centres, and 462 foreign researchers were hosted by CSIC centres.

Also, together with other national institutions, such as the Ministry of Foreign Affairs, the CSIC also collaborates with numerous countries

through joint commissions, the Spanish International Cooperation Agency's Programme, and the Inter-university Cooperation Programme. In 2005 alone the CSIC's researchers worked on a total of 55 projects with teams from developing and transition economy countries, Including Morocco, Tunisia, China, Namibia, Poland and Slovenia. During the same year the CSIC's researchers took part in 101 Integrated Actions (Ministry of Education and Science), with Austria, Portugal, France, Italy, Hungary, Greece and Germany. Moreover, 64 foreign scientists and technologists visited the CSIC's centres for periods of study or research, and 39 professors from abroad took sabbaticals with the CSIC.

The CSIC also plays an active role in the various different types of scientific and technical cooperation run by the European Science Foundation (Exploratory Workshops, Networks, à la carte programmes, Euroconferences, etc..) and collaborates on the design of new science policy and strategies through the participation of its researchers in Standing Committees, Expert Committees, etc. The CSIC also participates in EuroHORCS, and in particular in the EURYI programme, in a number of other bilateral and multilateral initiatives sponsored by various international bodies.

RESEARCHER TRAINING

Researcher training is managed by the Postgraduate and Specialisation Department (*Departamento de Postgrado y Especialización*, DPE). This department's goals are to contribute to defining and implementing the CSIC's policy in terms of researcher training and organising the range of teaching offered so as to contribute to improving the quality of higher education and providing further training to specialised professionals. Since it was created in 1985 the Postgraduate and Specialisation Department has been responsible for implementing the CSIC's grants and scholarships programmes. Researcher training has been one of the CSIC's goals since its inception, and since 1999 its grants and scholarships programmes have also included researcher training goals in areas involved in the productive sector, thus responding to society's demands for the level and quality of employment to be improved.

The Postgraduate and Specialisation Department also promotes and takes part in activities aiming to attract university students to the CSIC's research institutes and centres and to make its range of scientific training known among university students through forums and on the web. The Postgraduate and Specialisation Department

TABLE 2.5

GROWTH IN THE NUMBER OF GRANTS MANAGED BY THE DPE OVER THE PERIOD 2000 TO 2005

Year	Grants
2000	1,472
2001	1,456
2002	1,537
2003	1,656
2004	1,805
2005	2,254

also jointly manages other organisations' grant programmes where they involve work at the CSIC's centres and organisations. The total numbers of grants managed in the period from 2000 to 2005 are shown in table 2.5.

Postgraduate and Specialisation Department pools and disseminates information about post-graduate courses run by researchers at the CSIC's centres and institutes, including courses run by the CSIC on its own and those run in conjunction with other institutions, universities, companies, scientific societies and professional associations. The range offered includes a wide range of content and development, from the most interdisciplinary to the monographic. A significant share of the CSIC's courses form part of universities' doctorate programmes. During the 2005-2006 academic year 119 specialisation courses and 18 highly specialised courses were given, with a total of 382 and 221 credits, respectively. The number of students on these courses varies widely, depending on the nature of the course. Numbers ranged between 10 and 50, with a value of around 20 being the most frequent.

KNOWLEDGE TRANSFER

Historically the CSIC has played a leadership role in organising technology transfer from Spanish academia to productive sectors. Knowledge transfer of public research as it is understood today began at the CSIC with the creation of the Technology Transfer and Exploitation Office (*Oficina de Valoración y Transferencia de Tecnología*, OVTT) in 1985, within what was at that time the Presidency's Studies Office. This began the process of creating a culture and know-how which is still held up as a model for other entities of similar characteristics. In fact, staff who had been trained at the OVTT were involved in the creation of the Office of Technology Transfer at the General Secretariat of the National R&D Plan in 1989, and the model they used when setting up the network that was then known as «Red OTRI/OTT» was that of the CSIC. Also, the first course for OTRI technical staff was run in Segovia by the OVTT in 1988, and since that time members of what is now known as the Technology Transfer Office (*Oficina de Transferencia de Tecnología,* OTT) have been involved as speakers.

The activity of the CSIC's researchers over the years has positioned CSIC as the national leader in technology transfer. The CSIC's indicators on this subject also compare well with those of similar insti-

tutions in other countries. Some data, for the purposes of illustration, include:

- According to the World Intellectual Property Organisation (WIPO), in 2004 the CSIC was in 170th place in the ranking of international patent applications among institutions of all types, both private and public, with a total of 63 applications. This figure places the CSIC in second place among European research organisations, after the CNRS (France), which filed 185 applications and holds 40th position in the ranking, or third if we consider the Fraunhoffer Society, which with 171 applications holds 49th position. The Massachusetts Institute of Technology (MIT) held 100th place with 97 applications. The first academic institution, in 29th place is the University of California (which groups together four public university campuses in the state), which filed 278 applications.
- According to the same source, the CSIC held first place among public and private Spanish institutions in terms of the number of international patent applications filed.
- In 2004 the CSIC accounted for 47% of international patents applications filed by the public sector in Spain[1].
- In 2004 the CSIC held overall first place in the number of patents applied for at the Spanish Patents and Trademarks Office (*Oficina Española de Patentes y Marcas*, OEPM)[2].
- Since 1999, 41 technology-based companies with ties of varying sorts to the CSIC have been set up. This figure compares well with the almost 40 created at the UCLA since 1990[3] or the 34 created by the Max Planck Society since 2000[4].

In 2004 the percentage of the CSIC's total budget from contracts with companies was approximately 7.6%, as compared with 11% of the MIT's budget in 2005[5].

The observation of the time series of the CSIC's technology transfer indicators also reveals a positive trend. Figure 2.9 shows the progress of numbers of Spanish and international patent

The CSIC's IT centre (*Centro Técnico de Informática,* CTI) was set up in 1990 to provide IT support to the CSIC's units and centres. The CTI is responsible for two ambitious projects, the e-Government Systems Plan *(Plan de Sistemas para la Administración Electrónica)* and the Scientific Research and Development Technical Support Programme *(Programa de Apoyo Técnico a la Investigación y Desarrollo Científico)*. The first of these envisages improving the CSIC's IT infrastructure and services and reviewing and simplifying the procedures to reach a new management model. The second envisages a significant increase in the computational power and value added services available to the CSIC's research teams.

[1] Source: CINDOC-CSIC Bibliometrics Group.

[2] Source: Oficina Española de Patentes y Marcas (OEPM).

[3] Source: Lorelei de Larena, UCLA Intellectual Property Manager, presentation at the WIPO Conference in International Science and Technology Collaborations, April 25/26, 2005.

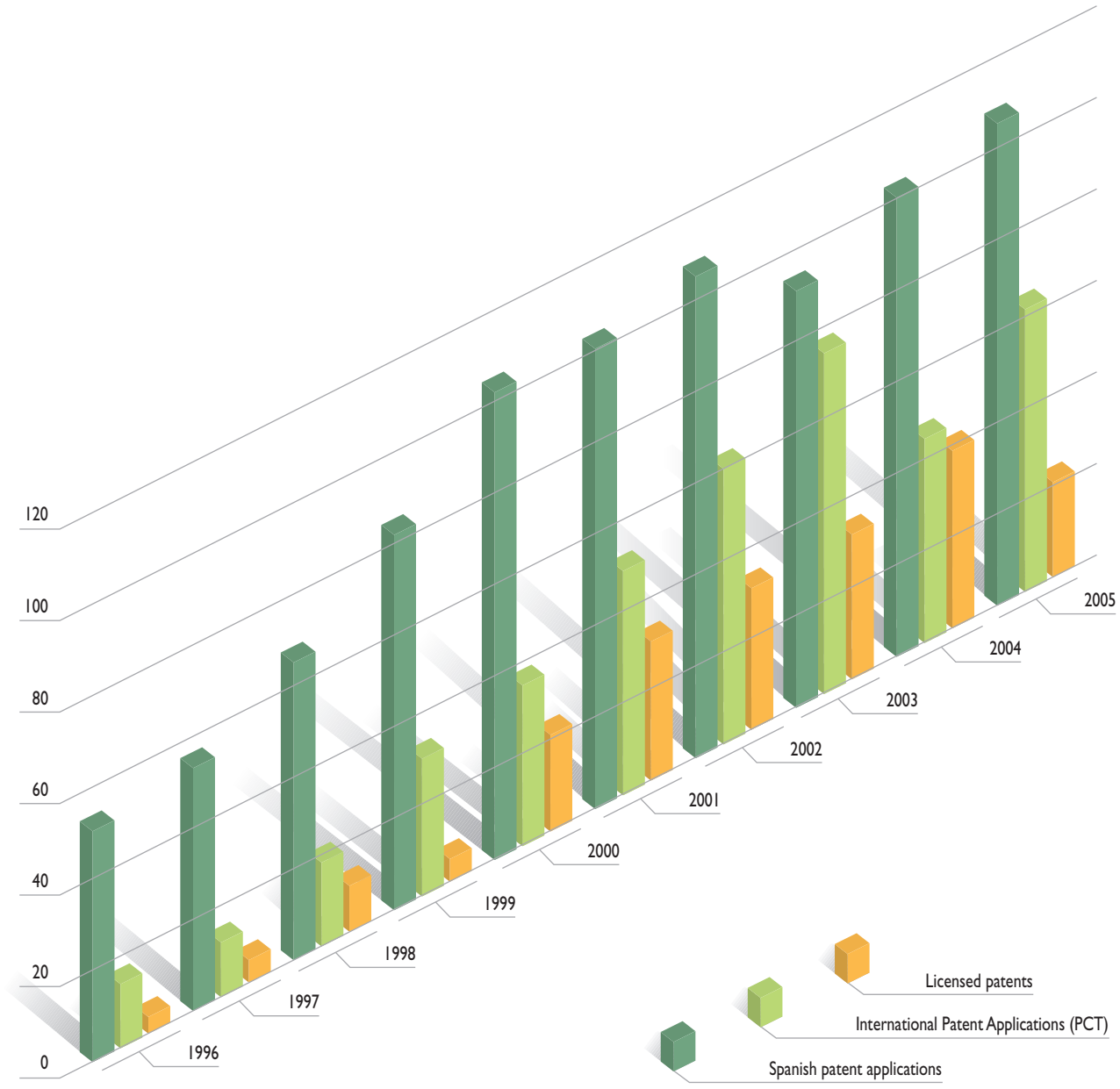
[4] Source: web site of Garching Innovation, a company set by the Max Planck Society for technology transfer.

[5] Source: Ann M. Hammersla, Senior Counsel Intellectual Property MIT, presentation at the WIPO Conference in International Science and Technology Collaborations, April 25/26, 2005.

applications[6] and the number of patents licensed to companies for their exploitation.

FIGURE 2.9

PROGRESS OF THE NUMBER OF SPANISH AND INTERNATIONAL PATENT APPLICATIONS AND OF THE NUMBER OF PATENTS LICENSED FOR EXPLOITATION

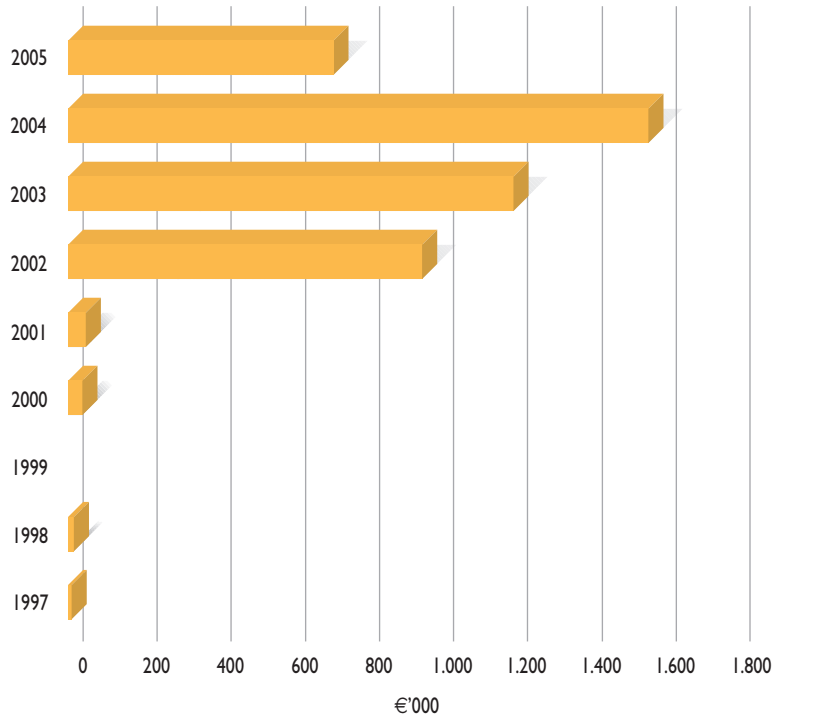


[6] The normal procedure used by the OTT means the application for an international extension to a Spanish patent does not take place until one year after it has been registered with the OEPM. Therefore, the most realistic comparison would be between the number of Spanish patents applied for in a given year and the number of international patents applied for the following year.

As was mentioned above, the number of patent applications is comparable to that of counterpart institutions elsewhere in the world. The percentage of licensed patents is high. Again this is comparable with, or even higher than, that of counterpart institutions. Figure 2.10 shows the growth in income from royalties generated by the contracts licensing exploitation of the CSIC's patents. Bearing in mind that the length of time needed to bring a new technology or research finding to market and for it to generate income can be several years, the data in the figure are extremely promising.

FIGURE 2.10

GROWTH IN INCOME FROM ROYALTIES FROM CONTRACTS TO LICENSE THE CSIC'S PATENTS



Data from 26 June 2005.

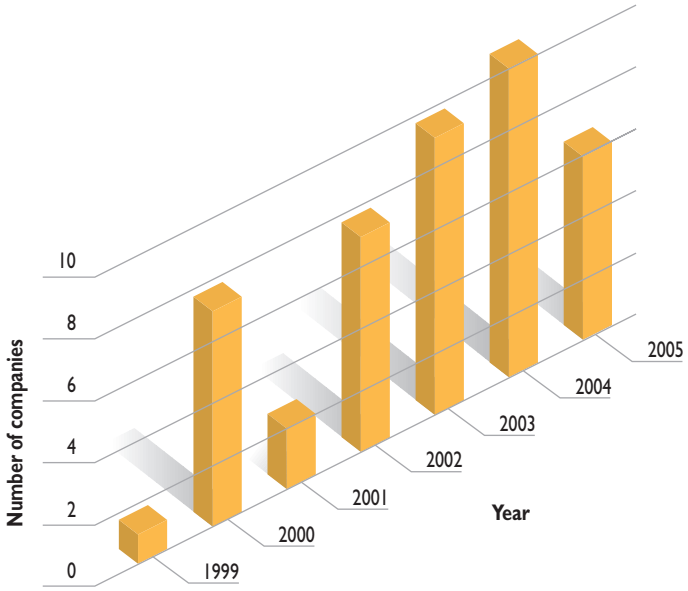
Figure 2.11 shows the growth in the number of technology-based companies created in relation to the CSIC.

The CSIC's experience shows the importance of setting up structures with which to promote and commercialise research findings and capabilities. This experience is in line with that of other similar organisations, in particular those in the English-speaking countries and the Max Planck Society.

In 2000 an initiative was begun so as to develop a culture of quality at the CSIC's units and centres. This initiative aims to ensure the quality of the institution's scientific and technological services by establishing the modifications and improvements needed to achieve accreditation under the ISO 1025 standard, or that of equivalent quality systems. The implementation took place in close collaboration with the Madrid Regional Government *(Comunidad de Madrid)* and there are plans to extend it to centres and institutes in other Autonomous Regions.

FIGURE 2.11

GROWTH IN THE NUMBER OF TECHNOLOGY-BASED COMPANIES CREATED WITH LINKS TO THE CSIC. DATA FROM 26 JUNE 2005



POPULARISING AND COMMUNICATING SCIENCE TO SOCIETY

As well as undertaking top quality scientific research and transferring its empirical results and the knowledge obtained to the productive sector, another important task of the CSIC is to promote scientific culture in society through the popularisation and communication of science to society. Society needs to know what kind of scientific research a public institution like the CSIC does and how it does it, given that it is supported by taxpayers' money. Communicating research to the public and raising public awareness on research-related topics, in the broadest sense, are not tasks that are necessarily easy or obvious. Knowing how to communicate is as important as knowing how to do research. Aware of the challenge that transmitting scientific advances to society entails, in 2004 a Scientific Culture Area was set up within the CSIC. This area is responsible for coordinating the CSIC's activities in relation to the dissemination of science, in a broad sense, and raising public awareness of scientific research and researchers. Since its creation the Area has coordinated numerous events, such as conferences, scientific fairs, exhibitions, workshops, round tables and showings of science films, etc.

Additionally, through its «*CSIC en la Escuela*» (CSIC in schools) programme, it runs a variety of science teaching activities. These included the *Premio Arquímedes* (Archimedes Prize) for research activities in the classroom (3rd edition in 2005), the development of IT applications such as the CSIC's Virtual Campus and Virtual Museum (http://museovirtual.csic.es/), and running a number of courses, seminars and experiments at schools in the Madrid Region. The third national congress on science in primary and pre-school teaching (*«La Ciencia en las Primeras Etapas de la Educación»*) was also held in 2005 (in Madrid).

Another important tool for the CSIC's scientific outreach activities is its digital media library (*Mediateca*), which was created in 2002 as a collaborative undertaking involving the CSIC, the Spanish scientific film association ASECIC (*Asociación Española de Cine Científico*) and the Madrid Regional Government (*Comunidad de Madrid*). Its main aim from the outset has been to become a meeting place for anyone interested in popularising and disseminating science. Since it opened to the public in 2003 at the National Natural Science Museum, the digital media library has been visited by more than 33,000 people.

Lastly, the CSIC also has a Communication Department, which follows up news about the CSIC in the press, radio, television and online and calculates the economic value of these news items. This department is also responsible for interaction with the media when disseminating the results of research carried out by the CSIC which has a potential direct impact on the public.

The CSIC has a publications department responsible for editing, production, dissemination, distribution and sale of the CSIC's periodicals and one-off publications.

In 2005 this department published 130 books, distributed in 63 open collections, and 32 periodical publications. A total of 6,201 subscription requests were received, 3,700 from Spain and 2,501 from abroad. The CSIC's bibliographical/historical collections, which are managed by the publications department include between 10,000 and 12,000 titles, of which over 2,500 are listed on its catalogue of items on sale to the public.

3 SWOT ANALYSIS

The central plank of the CSIC's Action Plan consists of an analysis of the institution's strengths and weaknesses, and the threats and opportunities arising in the environment in which it works. According to these elements of the analysis and the interactions between them, a strategy of future actions has been defined so as to leverage the institution's strengths to the full, to try to overcome the weaknesses detected, where possible, to exploit the opportunities, taking into account the two preceding factors, and to protect the institution against external threats, or at least, to anticipate their effects.

STRENGTHS

- **Research staff**

  The CSIC has a large research staff compared to other national research institutions in Spain. In 2005 it had a total of 3,202 researchers, of whom 758 were employed on normal contracts (Ramón y Cajal, Juan de la Cierva, I3P, etc.) and the remainder, 2,444, were employed as public servants. The Institution also had 3,806 research fellows, and 3,626 technicians and research support staff. The CSIC's research staff work at a total of 116 research institutes, covering almost all fields of knowledge. The CSIC is the Spanish state's largest institution dedicated solely to research. One clear advantage of having a large workforce is the institution's greater ability to respond to socio-economic changes calling for an increase or a reduction in scientific research in particular areas. Moreover, given the multidisciplinary nature of its research work, the CSIC can respond to the needs of the social and economic environment on almost any topic. This has made the CSIC a reference institution at the national level, and to a lesser extent, on an international level too.

  Despite the fact that the CSIC has the largest number of researchers of any Spanish research institution, in absolute terms, comparing with either national or international bodies, the number is small. Thus, the CSIC accounts for barely 6% of Spain's total researchers (INE 2004 data). In relation to European institutions of similar characteristics, the nearest comparisons to the CSIC in terms of the size of the workforce devoted to research are the Max Planck Gesellschaft and the CNR in Italy (See table 3.1). However, in terms of its administrative structure and staff, the

TABLE 3.1

DATA ON STAFF OF CSIC AND OTHER EUROPEAN RESEARCH INSTITUTIONS

	Researchers	Total
CSIC	3,202	8,673
CNR	4,284	8,015
Max Planck	4,113	12,153
CNRS	11,644	26,060

Data from 31 December 2004.
(Does not include pre-doctoral trainees).

CNRS in France is a closer comparison, although it has a much larger workforce.

Although it only employs 6% of Spain's researchers, the CSIC accounted for 19.6% of the total national output of publications in indexed journals in 2004. This is evidence of the high scientific productivity of the CSIC's researchers, which is more than 3 times above the national average (by EJC).

These data highlight that the CSIC's human capital is one of its main assets and a clear strength of the institution. Whatever strategy is adopted must take this strength into account and build on it. The institution must make a strong commitment to bolstering its research staff. Offers of public employment (OEP) in 2006 have supported moves in this direction, with more positions offered than in the previous year, indeed the number of jobs offered was unprecedented in the institution's history (see table 3.2). However, despite its generosity, the CSIC's 2006 offer of public employment still falls a long way short of that of other equivalent European institutions. Thus, for instance, in 2006 the CNRS put on offer posts for 410 tenured scientists, more than twice the number of positions available at the CSIC (200 new posts for tenured scientists). Over the next few years while the Action Plan is in force, the CSIC must keep trying to expand its research workforce by urging the public powers to provide adequate numbers of positions in the institution so as to move in the direction set out in the Lisbon Strategy, which set the goal of increasing the total number of researchers in the European Union to 700,000 by 2010.

- **Multidisciplinarity**

  Ever since its creation the CSIC's scientific work has frequently been multidisciplinary. However, this multidisciplinarity takes on special relevance in research worldwide today, where the frontiers between traditional areas of knowledge have become blurred and every day new hybrid disciplines are appearing in areas that were previously separate. The CSIC has been promoting the fusion of different bodies of knowledge and the emergence of new hybrid, interdisciplinary areas for many years. Two examples of this process are the creation in the 80s of the Materials Sciences and Technology and the Food Sciences and Technology areas, which constitute the interfaces between more traditional areas of knowledge such as physics, chemistry and engineering, in the former case, and chemistry, biology and agricultural science, in the latter. It is nowadays increasingly common to see in-

TABLE 3.2

THE CSIC'S 2006 OFFER OF PUBLIC EMPLOYMENT

BODY/SCALE	New posts	Internal promotion	Total
Research professors at the CSIC	8	50	58
Research scientists at the CSIC	11	110	121
Tenured scientists at the CSIC	200	10	210
Higher scientific officers at the CSIC	20	10	30
Museum Curators	3		3
PRO intermediate specialist technicians	40	4	44
Archive, library and museum assistants	5		5
Management of IT and systems in the national government	4		4
National government management	6	2	8
PRO research assistants	35	15	50
Ancillary IT technicians in national government	2		2
Archive, library and museum ancillaries	2		2
National government management administrators		10	10
PRO research ancillaries	13		13
TOTAL PUBLIC SERVANTS	**349**	**211**	**560**
TOTAL CONTRACT STAFF	**10 (*)**		**10 (*)**
TOTAL PUBLIC SERVANTS AND CONTRACT STAFF	**359**	**211**	**570**

* Contract positions occupied by temporary staff.

teractions of this type between different disciplines so as to allow problems to be tackled that are insoluble when looked at from the viewpoint of just one of the disciplines concerned. Thanks to its highly multidisciplinary workforce and the management's strong commitment to encouraging constructive interactions, a fertile environment has been created in which to produce new scientific value and adapt to new times and new ways of working in science, which is today more globalised than ever. At present, the CSIC's researchers and centres/institutes are organised administratively into 8 large scientific and technical areas which cover practically all the areas of knowledge taught in universities (see table 3.3).

However, researchers and institutes increasingly find themselves between two or more areas, doing research work that cannot be classified in any existing field. This intensive scientific activity is evidence of the vitality and dynamism of both the CSIC's research and its research staff. It is also a clear sign of the way new angles on the world's problems are constantly arising, and offers a justification of scientific research as satisfying both the yearn-

ing for knowledge that is innate in human beings, and society's desire to see its problems solved.

In the R&D innovation policy scene in both Spain and Europe there is a drive to promote high potential value but high risk research at the border between different areas of knowledge and which in turn comprise projects at the frontiers of knowledge. As the national implementation of the Lisbon Strategy of 2000, the INGENIO2010 plan envisages various actions aiming to boost interactions between areas and taking on high risk projects with a high strategic value. Programmes such as CONSOLIDER, CIBER, CENIT or EXPLORA (part of INGENIO2010) form part of this philosophy. On a more modest level, before INGENIO2010 came on the scene a programme of in-house projects, the in-house frontier projects (*Proyectos Intramurales de Frontera*, PIF), was set up in the CSC with a similar philosophy. This programme is currently at its third call for proposals and is proving itself to be an effective means of searching out, facilitating, bolstering and exploiting interactions between CSIC researchers in different areas (figure 3.1). It has also led to the appearance of new topics that were not previously being explored and not being backed by traditional research funding at national or European level. Programmes such as the CSIC's PIF demonstrate the institution's strong commitment to frontier research that emerges and is developed in the difficult but fruitful intersection between scientific areas.

FIGURE 3.1

MULTIDISCIPLINARITY IN THE IN-HOUSE FRONTIER PROJECTS (PIF) PROGRAMME 2004 AND 2005

The graphic shows the projects in which research groups from more than one area are involved. The size of the bubble represents the number of joint projects (see legend) in the areas shows along the x-axis (main area coordinating the project as a whole) and y-axis (participating area) in each case.

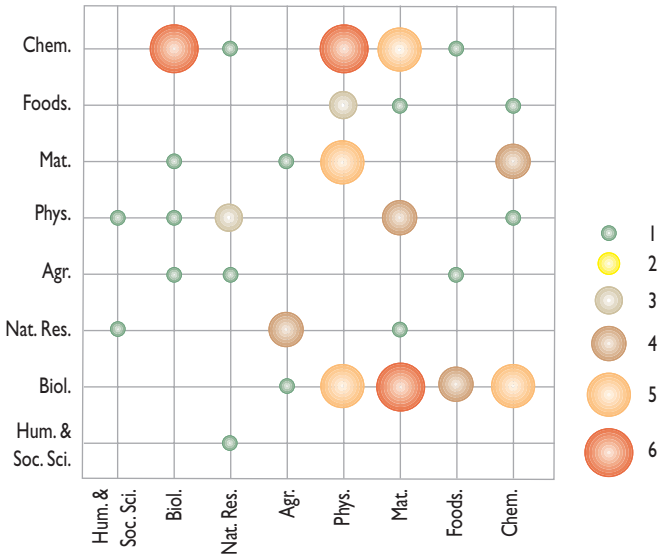


TABLE 3.3

CSIC SCIENTIFIC-TECHNICAL AREAS AND UNIVERSITY AREAS OF KNOWLEDGE IN EACH OF THEM

Humanities and Social Sciences	Biology and Biomedicine
Regional Geographical Analysis	Comparative Anatomy and Pathological Anatomy
Social Anthropology	Human Embryology and Anatomy
Archaeology	Computer Technology and Architecture
Librarianship and Documentation	Cellular Biology
Political and Administration Science	Biochemistry and Molecular Biology
Applied Economics	Pharmacology
Agricultural Policy, Economics, Sociology	Atomic, Molecular and Nuclear Physics
Arab and Islamic Studies	Physiology
Hebrew and Aramaic Studies	Plant Physiology
Graphic and Architectural Expression	Genetics
Greek Philology	Immunology
Latin Philology	Microbiology
Romance Philology	Parasitology
Philosophy	Animal Production
Philosophy of Law	Vegetable Production
Moral Philosophy	Psychobiology
Fundamentals of Economic Analysis	Analytical Chemistry
Human Geography	Organic Chemistry
Ancient History	Food Technology
Contemporary History	
History of America	
History of Science	
History of Art	
History of Law and Institutions	
History of Thought and Social Movements	
Medieval History	
Modern History	
Spanish Language	
Spanish Literature	
Logic and Philosophy of Science	
Music	
Business Organisation	
Prehistory	
Sociology	
Environmental Technologies	
Literary Theory	

Natural Resources
Botany
Crystallography and Mineralogy
Ecology
Pedology and Agricultural Chemistry
Stratigraphy
Applied Physics
Condensed Matter Physics
Physics of the Earth
Physiology
Plant Physiology
Genetics
External Geodynamics
Internal Geodynamics
Physical Geography
Human Geography
Chemical Engineering
General Linguistics
Fluid Mechanics
Microbiology
Optics
Palaeontology
Parasitology
Petrology and Geochemistry
Animal Production
Vegetable Production
Psychobiology
Analytical Chemistry
Animal Health
Food Technology
Environmental Technologies
Zoology

Agricultural Sciences
Cellular Biology
Biochemistry and Molecular Biology
Crystallography and Mineralogy
Ecology
Pedology and Agricultural Chemistry
Physics of the Earth
Plant Physiology
External Geodynamics
Agroforestry Engineering
Electrical Engineering
Hydraulic Engineering
Microbiology
Parasitology
Petrology and Geochemistry
Animal Production
Vegetable Production
Analytical Chemistry
Inorganic Chemistry
Animal Health
Food Technology
Environmental Technologies
Toxicology
Zoology

Physical Sciences and Technologies
Computer Technology and Architecture
Astronomy and Astrophysics
Computational Science and Artificial Intelligence
Crystallography and Mineralogy
Electromagnetism
Electronics
Statistics and Operations Research
Applied Physics
Atomic, Molecular and Nuclear Physics
Condensed Matter Physics
Physics of the Earth
Theoretical Physics
Geometry and Topology
Automation and Systems Engineering
Computer Languages and Systems
Applied Mathematics
Optics
Social Psychology
Physical Chemistry
Electronic Technology
Communications and Signal Theory

Materials Sciences and Technology
Materials Science and Metallurgic Engineering
Architectural Construction
Crystallography and Mineralogy
Electromagnetism
Applied Physics
Atomic, Molecular and Nuclear Physics
Condensed Matter Physics
Construction Engineering
Chemical Engineering
Optics
Analytical Chemistry
Physical Chemistry
Inorganic Chemistry
Organic Chemistry

Food Sciences and Technology
Biochemistry and Molecular Biology
Microbiology
Nutrition and Bromatology
Animal Production
Analytical Chemistry
Physical Chemistry
Food Technology

Chemical Sciences and Technology
Biochemistry and Molecular Biology
Materials Science and Metallurgic Engineering
Pedology and Agricultural Chemistry
Pharmacology
Internal Geodynamics
Chemical Engineering
Textile and Paper Engineering
Fluid Mechanics
Nutrition and Bromatology
Petrology and Geochemistry
Analytical Chemistry
Physical Chemistry
Inorganic Chemistry
Organic Chemistry
Environmental Technologies
Toxicology

- **National and international public image**

  The CSIC is extremely well regarded by the public. In 2005 the CSIC generated a total of 15,540 news items in the media, of which 8,023 were published in traditional media (press, radio and television) and 7,517 were published in digital media[7]. In many cases these news items referred to research undertaken by the CSIC in various spheres of activity. However, it is also common for media professionals to come to the CSIC and its researchers for up-to-date information about news items, discoveries or alerts occurring around the world, even though the institution was not the source. This highlights the good image the CSIC has as a benchmark scientific institution, able to provide society with trustworthy information on any event relating to science and scientific research.

- **Pool of researchers**

  One of the CSIC's missions as a reference research institution in Spain is to train qualified research personnel. Although it is not

[7] «Informe de Visibilidad 2005: El CSIC en los medios» (Visibility report 2005: The CSIC in the media) Communication Department.

TABLE 3.4

MEC PREDOCTORAL GRANTS ASSIGNED TO CSIC RESEARCH FELLOWS IN 2005

Programme	CSIC	Total	%
FPI	190	950	20
FPU	126	950	13.3
Total	**316**	**1,900**	**16.6**

an academic institution, the CSIC is chosen by many post-graduates as the place to do their doctorate. In 2000-2004, 2,245 doctoral theses were completed by postgraduates at CSIC centres and institutes, representing 7.1% of PhD theses over this period. In 2005 the number of theses completed at the CSIC was 648, which is in line with the institution's historical percentage. In the same year, the CSIC hosted 2,254 pre-doctoral research fellows on various programmes run at national and regional level any by foundations.

The ability of the CSIC to attract doctorate students is shown by the high percentage of pre-doctoral grants awarded under national programmes. In 2005 the CSIC hosted 126 students with university personnel training grants (*Formación de Personal Universitario*, FPU), and 190 students with research personnel training grants (*Formación de Personal Investigador*, FPI), thus accounting for 13.3% and 20%, respectively, of the total number of grants awarded under each of these programmes in 2005. These percentages are higher than one would expect on the basis of the relative size of the CSIC's research staff as a share of the national total. Thus, although its researchers account for 6% of the national total, the CSIC received 16.6% of all predoctoral grants awarded from national funds.

On the other hand, consistent with its commitment to researcher training, over the last few years the CSIC has run the I3P programme of predoctoral grants, which is co-financed by the European Social Fund. In 2005 a total of 165 I3P grants were awarded, 10% more than in 2004. I3P predoctoral grants are comparable with the Ministry of Education and Science's (MEC) research personnel training (FPI) grants in terms of their benefits and duration. The CSIC also awards postgraduate study grants through the I3P programme. These grants have a duration of one year and their aim is to train young researchers with a view to their taking up employment in the private sector. Many of these grants are co-financed by companies interested in training the grant-holder concerned. In 2005 the CSIC awarded 165 I3P postgraduate grants. These have similar characteristics to the pre-doctoral grants but are shorter in duration.

In addition to this doctorate training the CSIC also runs programmes aimed at other stages of researcher training, such as before or after preparing the doctoral thesis. Thus, the CSIC offers grants to students in the last two years of a higher degree course to introduce them to research by funding them to stay at CSIC centres for 3-4 months, with the aim of creating an interest among students in going on to become researchers. In 2005 the CSIC received 200 students at various centres and institutes through this programme.

Postdoctoral training at the CSIC is of particular importance as it is the phase immediately before that at which researchers can join the institution's scientific staff. The CSIC currently receives post-doctoral researchers funded by various programmes, including its own programmes and those of other institutions, in particular the Ministry of Education and Science (MEC). The CSIC's post-doctoral researcher funding programme forms part of the I3P initiative, and as in the case of pre-doctoral grants, it is co-financed by the European Social Fund. In 2005 the CSIC awarded 150 contracts for post-doctoral researchers through this programme. These work-experience contracts have a duration of three years and enable their beneficiaries to join research groups with the institution and obtain high quality postdoctoral training.

The CSIC also receives post-doctoral researchers from the Ministry of Education and Science's (MEC) «Juan de la Cierva» and «Ramón y Cajal» programmes, as well as other smaller scaler programmes such as the «Averroes» programme run by the *Junta de Andalucía* (Andalusian Regional Government), the «Parga Pondal» run by the *Xunta de Galicia* (Galician Regional Government), and the ICREA programme run by the *Generalitat de Cataluña* (Catalonian Regional Government). In 2005 50 researchers joined the CSIC on the «Ramón y Cajal» programme, bringing the total number of researchers who have worked for the CSIC under this programme during the time it has been in force (2001-2005) to 652. These contracts represent 26% of the total granted by the MEC in the framework of the «Ramón y Cajal» programme.

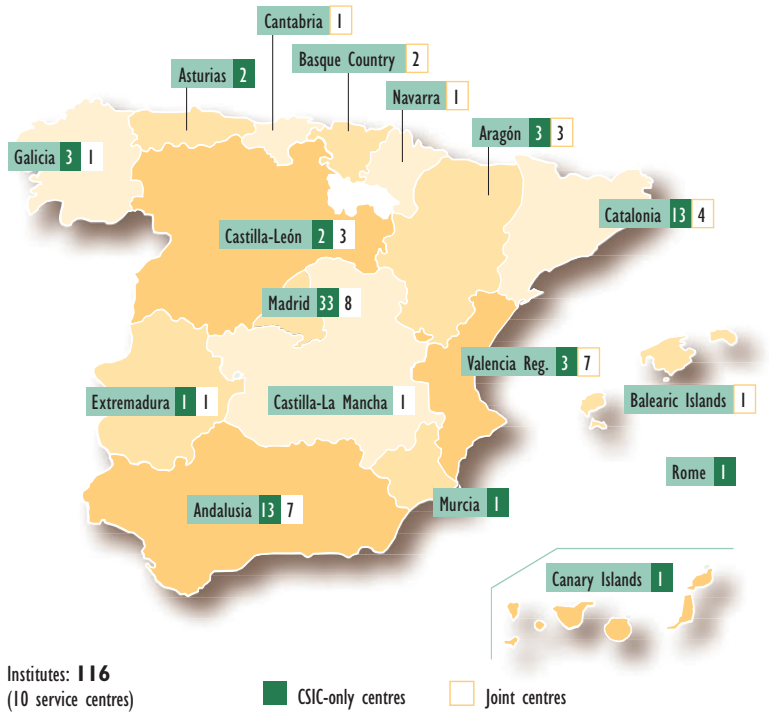
The range of programmes for young researchers at the CSIC covers all stages from pre-graduate through to the most advanced postdoctoral level, configuring the institution's research career. Researchers trained at the CSIC are an important asset not only for the institution itself, but for the Spanish scientific system as a whole. Many of these researchers end up joining the CSIC as tenured scientists, although large numbers also join other institutions, making this is one of the ways in which the CSIC plays its role as the organisation structuring science and research in Spain by creating a pool of highly trained young researchers.

- **Established nationwide**

  Unlike other institutions in the Spanish scientific system, the CSIC is established in practically the whole of Spain, with centres and institutes in the majority of the country's Autonomous Regions, the sole exception being La Rioja (Figure 3.2).

FIGURE 3.2

NETWORK OF CSIC INSTITUTES. Through this network, and the Institution's Associated Units, the CSIC collaborates with 40 universities and 27 other institutions (other PROS, Regional Governments and Local Bodies)



This spread of the CSIC's research efforts is a clear strength of the institution. In effect, by having centres and institutes in all Autonomous Regions the CSIC can take advantage of the opportunities created by regional governments in the scientific research field. In turn, the CSIC and its researchers can respond better and more directly to the specific needs of each region.

At the same time, through its having the status of a national body, the CSIC's researchers enjoy greater mobility between institutes than those in other institutions, and the interaction and collaboration between personnel at different centres and institutes is encouraged. The advantages of the CSIC's nationwide scope can be summarised as follows:

– More possibilities of mobility for its researchers
– It can give a more rapid response which is better tailored to the local environment and demands
– More opportunities for collaboration with other local and regional institutions

- Easier interaction with regional productive sectors
- Groups together and coordinates efforts by other institutions belonging to the autonomous regions which are regional in scope by extending the reach of their activities to national level.
- Greater visibility in society.
- Permits integration and coordination of large-scale research projects that require different scientific specialisations and geographical environments beyond the reach of an Autonomous Region.

Over the coming years the CSIC will continue expanding its coverage to ensure it is represented in all the Autonomous Regions, including La Rioja, where a viticulture and viniculture research centre is due to be opened. Moreover, in those regions where the CSIC is less represented, efforts will be made to set up more institutes, in the form of either CSIC-only centres or joint centres with other institutions.

- **Good infrastructure (at national level)**

  In general terms, the CSC has the largest set of scientific facilities at national level in Spain. The quality of the research carried out by the CSIC's researchers, and their dedication and entrepreneurship, have led Spanish and international researching funding agencies to devote a large percentage of their budgets to the CSIC's institutes and centres. Moreover, many of the CSIC's centres and institutes have modern, well equipped facilities which are home to latest generation, high technology infrastructure. This infrastructure is of two main types:

  - Facilities: large pieces of infrastructure requiring civil engineering works to house specific equipment and research which would not otherwise be feasible
  - Equipment: sophisticated and expensive pieces of scientific equipment

  In this section it is worth highlighting the role of the CSIC as the management body for Spain's large scientific facilities and the Spanish share of certain international facilities. Table 3.5 summarises the infrastructure available to or run by the CSIC.

- **Technicians**

  In 2005 the CSIC had 3,626 staff performing research support tasks. Although this number is not particularly high, and at any event, less than an institution the size of the CSIC would

TABLE 3.5

UNIQUE CSIC INFRASTRUCTURE AND FACILITIES

Unique Facilities	Large Scientific Facilities
Sierra Nevada Observatory	«Juan Carlos I» Antarctic Polar Base
Real Jardín Botánico (Royal Botanical Garden) Flora Collections	Estación Biológica de Doñana (Doñana Biological Station) Doñana Reserve
Museo Nacional de Ciencias Naturales (National Natural Science Museum) Collections	White room at the Instituto de Microelectrónica de Barcelona (Barcelona Microelectronics Institute)
Parque de Rescate de la Fauna Sahariana (Saharan Fauna Rescue Park)	«Calar Alto» Astronomy Centre
Residencia de Estudiantes	«Hespérides» Oceanographic Vessel
Institución Milá y Fontanals (Milá y Fontanals Institution)	«Garcia del Cid» Oceanographic Vessel
«La Casa del Chapiz» at the Escuela de Estudios Árabes (School of Arab Studies)	«Sarmiento de Gamboa» Oceanographic Vessel (under construction)
Misión Biológica de Galicia (Galicia Biological Mission)	

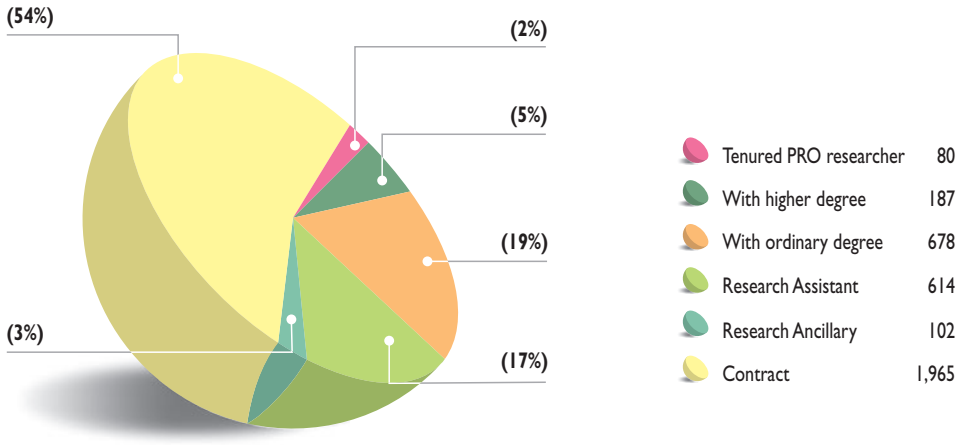
normally have, the CSIC's technicians are highly qualified and, given the institution's multidisciplinary nature, together able to cope with virtually all the methods and techniques currently used in research. The CSIC's technicians are of vital importance for the research conducted by the institution's research groups, and in many cases they embody the «memory» of technical knowledge of these groups, which are often made up of fluctuating numbers of researchers who often spend only a limited time with the group.

The CSIC's technical support staff consist of public servants and contract personnel. The public servants are further subdivided across four staff grades: those with higher degrees, first degrees, research assistants and research ancillaries. Since 2002 tenured PRO researchers are included in this category. The CSIC's contract staff are divided into four equivalent categories. Figure 3.3 shows the distribution of research staff in 2005.

The high quality of the CSIC's technical staff is reflected in the type of research conducted at the CSIC's centres and institutes. This research is often cutting-edge pioneering work that uses the latest and most sophisticated techniques and methods, requiring technical personnel to constantly update their knowledge in order to give the research groups they work with the support they need. This means that these personnel are becoming more highly trained and better qualified all the time. To help support personnel stay up-to-date the CSIC regularly runs a variety of specific courses for its technicians on a range of topics (Table 3.6). These courses are organised through the Training Bureau, which reports to the Human Resources Division. Also, to achieve a higher degree of specialisation and more in-depth knowledge of the topics

FIGURE 3.3

DISTRIBUTION OF THE CSIC'S RESEARCH SUPPORT PERSONNEL IN 2005



covered, the Postgraduate and Specialisation Department (DPE) also organises highly specialist courses. These training activities contribute to keeping the CSIC's technical staff well trained and ensures they are one of the institution's strong points, and an area which deserves bolstering, particularly by increasing staff numbers.

TABLE 3.6

CSIC TRAINING AND SPECIALISATION COURSES

Year	Training Bureau	Postgraduate and Specialisation Dept.
2002	233	158
2003	236	152
2004	238	133
2005	252	137

- **Knowledge Transfer**

  The CSIC has solid experience in the transfer of knowledge, and its approach is based on a mixed strategy based on adding dynamism and commercialising results. The dynamism strategy aims to encourage a culture shift in the organisation's scientific personnel, such that the number of researchers in the institution who are active in cooperation and transfer markets will gradually increase, while using information, advisory and management services to seek to lower the various barriers that exist. Commercialisation consists of performing specific actions to exploit and sell technologies and knowledge generated by the organisation.

  The CSIC uses various instruments to commercially exploit its knowledge: a) on-demand and/or collaborative R&D contracts with companies and institutions, b) protection of research results according to their characteristics and the target customer (for example, by secrecy, patenting, etc.), c) licensing intellectual property rights or know-how (or secret knowledge) to companies, and d) setting up technology based companies to exploit the CSIC's research findings or capabilities.

To implement the strategy thus defined, the CSIC has a Technology Transfer Office (*Oficina de Transferencia de Tecnología*, OTT), which is an organisational unit within the corporate core of the CSIC, reporting to the vice-presidency for scientific and technical research. The head office of the OTT is in Madrid, and it also has offices in Barcelona, Murcia, Santiago de Compostela, Seville, Valencia, Valladolid and Zaragoza. In 2005 the OTT employed 20 technical personnel backed up by 12 support staff. The OTT's staff is highly qualified and plays the role of an interface between the CSIC's researchers and the productive/business sector. In this role, the OTT consists both of professionals with a highly scientific/technical background, based throughout Spain, who carry out promotion, technology watch, and commercialisation of the research conducted at the CSIC, and legal experts, who take care of the interests of the CSIC and its researchers on legal matters relating to contracted research, intellectual property protection and exploiting research results.

The OTT also performs laudable work advising and supporting the CSIC's entrepreneurial researchers in ventures to create new technology-based start-ups to exploit research findings. By way of example, in this area of activity, up to 2005 the OTT had managed 28 spin-off projects involving CSIC personnel.

In 2005 the CSIC's transfers of technology to companies raised a total of €27.2 million. Table 3.7 summarises the activities managed by the OTT in 2005. The CSIC's technology transfer capacity will soon be boosted further by the creation of the company CSIC-K2B. Backed entirely with CSIC capital, this company will centralise the exploitation of the CSIC's research results to obtain value from them (see Chapter 5).

- **European funding**

  The CSIC's research is mainly financed by external funds obtained from source in Spain and abroad. European funds stand out among the CSIC's foreign sources of research funding. In 2005 the CSIC had 450 contracts in force for this same number of research projects under the 5th and 6th Framework Programmes (172 contracts under FP5 and 185 under FP6), the Marie Curie Programme (64 actions) and other actions (29 projects). In total, these actions meant the CSIC obtained €93.5 million in European funds for research. The CSIC acts as the coordinator for some (31) of these actions. Figure 3.4 shows the distribution of the CSIC's scientific actions across the scientific and technical areas in which it operates.

TABLE 3.7

ACTIVITY OF THE OTT IN 2005

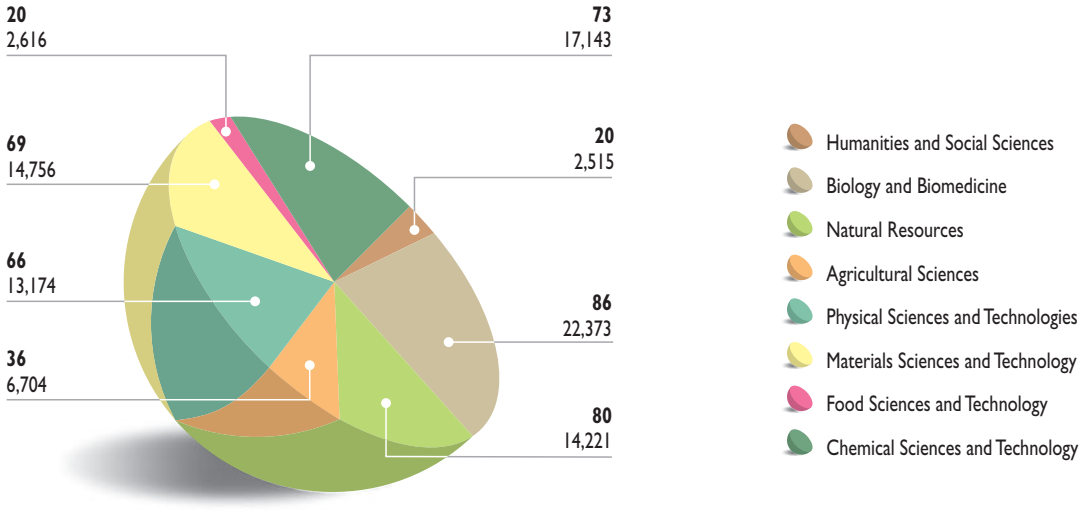
Patents and Utility Models	
173	
Licences	
Assignment of rights	2
Co-ownership	24
Licence to experiment	3
Licence to use	16
Licence to exploit	21
Option on licence	2
Total	**68**

Projects with Companies	
Association	45
Private company	833
Publicly owned company	50
Foundation	156
International (companies)	148
Natural persons	5
Spin offs	28
Total	**1,265**

The CSIC's level of participation in European programmes is the highest of all Spanish R&D organisations and it accounts for the largest volume of research funds from these programmes of any Spanish organisation in the R&D and innovation system, and must therefore be considered a strength of the CSIC in terms of defining its strategy over the years ahead. Nevertheless, over the last few years a drop in the level of participation of CSIC researchers in European projects has been detected, particularly as regards the coordination of actions, which has meant that the volume of European funds has declined in both relative

FIGURE 3.4

PROJECTS IN PROGRESS IN 2005 WITH FINANCE FROM EUROPEAN FUNDS
The number of projects and total funding obtained (in thousands of euros) in each CSIC Area is shown



and absolute terms. Thus, whereas the CSIC obtained €92.5 million from the Fifth Framework Programme (FP5), equivalent to 0.68% of the total programme budget (€13,700m), so far €74.9 million has been obtained from the Sixth Framework Programme (FP6), equivalent to 0.42% of the total budget (€17,883m), although it should be noted that FP6 has not yet ended and the final percentage could yet rise. This downward trend should not be ascribed to a drop in the quality or capability of the CSIC's researchers, but rather indicates problems in managing this kind of aid, whether institutional or arising from the administrative framework in which the institution operates. Returning the CSIC to its former level of participation and importance of its role in obtaining European research funding needs to be given priority to avoid this strength from turning into a weakness.

- **Interaction between basic and applied research**

  The broad spectrum of research conducted by the CSIC allows a direct and fruitful interaction between basic and applied research. Although the distinction between basic and applied research has always been somewhat illusory, as it would be necessary to talk instead of applications of research, today more than ever the limits of what has traditionally been called «basic» research and the practical application of that research are fuzzy and imprecise. Very often, applications emerge from research that might seem to be the most basic or fundamental, without requiring sudden jumps of changes of course. The advantages of the CSIC in this regard are significant because a large number of lines of research coexist in it, which, as discussed elsewhere here (Multidiciplinarity), allow different approaches to the same problems to be combined, thus encouraging inter-disciplinarity and a readier practical application of the discoveries made.

  Proof of this fruitful interaction between «basic» and «applied» research is given by the high number of patent applications handled each year by the CSIC's Technology Transfer Office (173 in 2005) or the spin-off companies that have been set up on the initiative of CSIC researcher's to commercialise research findings (10 in 2005). Therefore, this capacity for interaction between basic and applied research is clearly one of the institution's strengths. However, it is also something the institution needs to continue promoting and encouraging. Indeed, as will be discussed below in the section on Weaknesses, although this interaction between

basic research and applied research is one of the CSIC's virtues, and it takes place nationwide, the institution is still a long way short of the level of interaction typical of the world's leading institutions and countries in research and innovation. Moreover, there is a risk that researchers themselves will separate and contrast the ideas of basic research and applied research. This is partly due to dysfunctional schemas of promotion which do not take knowledge transfer issues into account, and issues relating to the education of the scientific community which only work to create an unproductive distancing of two viewpoints on a single research topic.

- **Interaction with technological and industrial sectors**

  Consistent with the strength just highlighted, the CSIC promotes and encourages a healthy interaction with technological and industrial sectors. A large proportion of the CSIC's researchers are highly aware that it is both appropriate and necessary to generate social and economic –and not just academic– value from their research. This means that these researchers involve themselves in research which is of direct interest to technology and industry sectors. Thus, for example, in 2005 at least a third of the CSIC's researchers (approximately 2000) were involved in contract research projects, which produced income of over €27 million.

  The interaction between the CSIC and the technological and industrial sector is currently a strength, but once again it is an aspect to which attention must be paid and which it is necessary to bolster and augment, particularly at this juncture, when new government programmes are being set up to promote and encourage links between research and industry, such as the CENIT project (part of INGENIO2010).

THREATS

- **Other research centres with more advanced, dynamic and competitive management**

  The current structure for contracting and internal management of the CSIC, which are subject to central government laws and regulations, mean that in some cases researchers' work is hindered by bureaucracy and paperwork that in other national institutions, and almost all foreign ones, are unnecessary or have been greatly simplified. This means that some CSIC researchers do not feel the institution to be a comfortable

environment in which to do their research. Although to date the CSIC has offered its researchers a series of advantages (facilities, infrastructure, a scientific atmosphere, etc.) that have made it attractive and offset the extra burden of a somewhat archaic administration not at all suited to the unique character of research centres, over the last few years centres of excellence in research have begun to appear in Spain that have good facilities and infrastructure, and a good scientific atmosphere, thus diminishing the CSIC's attractiveness as a research institution at which to conduct research that is competitive on the world level. These new research centres, such as the *Centro Nacional de Investigaciones Oncológicas* (National Oncology Research Centre, CNIO), the *Centro Nacional de Investigaciones Cardiovasculares* (National Cardiovascular Research Centre, CNIC), the *Centre de Regulació Genòmica* (Genomic Regulation Centre, CRG), the *Centro de Investigación Cooperativa en Biociencias* (Centre for Cooperative Research in Biosciences, CIC-bioGUNE), etc., have much more flexible management structures of a kind more suited to the realities of research work, thus relieving researchers from many bureaucratic tasks. The fact that these centres are often small, independent, focused on specific lines of interest, and well funded, makes them attractive to all researchers in the field. Moreover, these centres have a flexible contracting system that can be adapted to the qualities of the researchers contracted, thus making it possible for them to offer personalised conditions optimised to each individual case, which are generally much more generous than the CSIC is able to offer. This makes these centres very aggressive competitors for the CSIC and they are continuously drawing in its best talent from among scientists, technicians and managers, who are lured away by the pull of better installations, better management of research funds, and much more competitive contracting systems, levels of funding and salaries.

Although at the moment these centres are small players in the national R&D system, the outlook is for an increase in their number, at both national and regional level, over the years ahead.

These centres and institutes are a serious threat for the CSIC, which could see shrinkage in its workforce in terms of both absolute numbers and level of qualification, as the best staff are siphoned off.

Corrective measures urgently need to be put in place within the institution to tackle this real and growing threat and put a stop

to this plundering of the CSIC's best minds. It is not acceptable for the CSIC to have the training of top-rank research personnel as one of its goals but be unable to benefit from the work of these researchers once it has trained them.

- **Loss of centrality in regional scientific policy**

  The possible exclusion of the CSIC from programmes to promote R&D in the Autonomous regions is a threat hanging over the institution. The management systems the CSIC is obliged to use mean that it is sometimes difficult to implement regional research, development and innovation policies at its centres and institutions. The CSIC's management difficulties are due to the fact that it is subject to the laws governing other public bodies belonging to national government, although considerably less complexity. However, these difficulties are not taken into account by the bodies managing R&D policies in the Autonomous Regions and other institutions, which appreciate the easier and more rapid implementation possible to bodies belonging to, or transferred to, the autonomous regions, as is the case of many universities, hospitals, foundations, etc. These bodies often have specific agreements and can use systems for procurement and hiring staff that are more flexible, leading to easier and more effective execution of their research programmes.

  Obviously, research funding bodies are not always able to adjust their programmes to fit the administrative idiosyncrasies of the CSIC, particularly if other institutions in the system can meet their needs more readily. The possibility that the Autonomous Regions exclude the CSIC from their research programmes or give it a more marginal role is therefore a serious threat to the institution. This situation could be worsened still further if initiatives by certain Autonomous Regions aiming to set up research centres or institutions of their own are effectively implemented, as these centres would obviously be the main targets for the R&D policies of these regions.

- **Exclusion from specific scientific environments (health, stock breeding, energy, etc.) managed by other ministries**

  In a similar way to the case of the Autonomous Regions discussed in the previous section, the CSIC also faces a serious threat of being excluded or marginalised from national R&D policies, if it is unable to meet the challenge of orchestrating scientific policies on a national level. Although the CSIC's missions include –and this has to date been recognised by the main players in science

and research policy in Spain– structuring the Spanish R&D system, this central role may be undermined if it fails to implement specific programmes with a more forward-looking construction that has been habitual.

Moreover, the CSIC is already excluded from certain scientific areas where it can only take part as a «guest». This is the case of specific programmes run by the Ministry of Health, which are aimed more at the ministry's own centres, and in whose policies the CSIC does not have the degree of involvement in decision-making that might be desirable in view of the amount of research into biomedicine taking place at its centres and institutes, which incidentally produce the largest volume and highest quality work of all the centres and institutes in the national scientific system. The case of research into topics relating to agriculture and stock breeding is somewhat similar, but more extreme, given that, for example, policies relating to emerging animal diseases are defined behind the CSIC's back. Similarly, research policies on energy and environment matters are sometimes defined without taking the institution into account, although these topics widely studied at the CSIC's centres and institutes.

These cases occurring today are merely examples of what may happen to the CSIC's research in these areas in the future. Undoubtedly the CSIC will not be entirely excluded from them. This would be impossible given that it is the largest national research institution and the most productive, in both relative and absolute terms. However, the CSIC could lose its central role in the definition of research policies. It is also necessary to recognise that, to some extent, this exclusion of the CSIC from these spheres of decision-making is not solely the institution's responsibility, but rather a result of the competencies of institutions and ministries which are jealously guarding the functions entrusted to them. At all events, they are a clear threat for the CSIC over the coming years and must be taken properly into account in the strategy defined.

- **Exclusion from academic environments**

  Royal Decree 56/2005, 21 January 2005, regulating official postgraduate university studies (published in the official state gazette (BOE) number 21, pages 2846-2851, 25 January 2005) establishes the requirements and regulatory framework for the preparation and implementation of postgraduate studies. This Royal Decree also defines the formal aspects of the

preparation, direction and defence of doctoral theses. Nowhere in the Royal Decree is any consideration given to the unique features of the CSIC as leading national research institution. Although it might seem obvious, it is worth remembering that, as the country's largest research body and that with the highest largest scientific output, the CSIC and its research staff constitute the ideal environment in which to train new researchers, which is the goal of the doctoral stage of university teaching. Although doctors working at the CSIC can guide doctoral theses, this must take place within the framework of the postgraduate programme at a university. A situation that is closer to reality and clearly more feasible to run would be to allow the CSIC to operate as a body able to prepare and execute its own postgraduate programmes, and consequently, able to manage doctoral studies directly itself. Implementing this competency at the CSIC does not necessarily have to take place outside of the university environment. On the contrary, the CSIC's postgraduate and doctorate programmes could be supervised and accredited by the University Coordination Board (*Consejo de Coordinación Universitaria*) and could include lecturers and professors from various different universities on a hypothetical CSIC Doctoral Committee. This procedure not only guarantees the suitability and quality of the CSIC's doctoral programmes, but would also ensure the CSIC's doctorates are on a uniform level with those of Spanish universities. This latter point would represent significant value added which is not currently envisaged in any of the Spanish universities. Nevertheless, the Royal Decree alluded to above explicitly excludes this possibility of direct interaction between the CSIC and universities, which are clear companions and not competitors, in the national R&D system and in the training of researchers. This *de jure* exclusion of the CSIC from the academic environment, and the measures it promotes, can only result in the impoverishment of the researcher training system. This is worsened and made clearer if we consider that the system could benefit from the contrasting attitude of cooperation rather than futile competition. This situation represents a clear threat for the CSIC as an institution that could become isolated and inaccessible to the youngest group of trainee researchers. This situation is ironic when, up until now, the CSIC has been the institution that has always obtained the largest number of predoctoral FPI and FPU grants in the Ministry of Education and Science's calls for proposals,

and that it has its own I3P predoctoral grant programmes for this same purpose.

- **Difficulty obtaining funds due to changes in the research funding system based on reimbursable advances instead of subsidies**

  In recent years there has been a change in the way research funding from national sources is granted. The new system makes extensive use of soft (interest free) loans which are repayable over reasonable long periods of time. Although it is easy to appreciate that this system has a number of virtues (the biggest being perhaps the fact that it does not lead to a deficit for national government), given that research bodies can enjoy finance for their research work more rapidly than would perhaps otherwise be possible, the system nevertheless has a number serious drawbacks for its implementation by the CSIC, and for other public bodies, due to their being prohibited under government rules from taking on debt. This inconsistency in the national research funding system is a clear threat to the CSIC and can represent a serious obstacle to the institution's activities. Moreover, this is an obstacle that other bodies involved in research, such as universities, through their foundations, hospitals, etc. do not suffer from. This could have the end result of the CSIC's obtaining considerably less research funding, thus possibly even leading to its collapse.

- **More flexible European competitor organisations**

  The threat represented by the new national centres and institutes described above is even more apparent when considering Europe as a whole. The central and sectorial research organisations in various countries have operating structures that are much more agile than those of the CSIC. This means that these centres are much more competitive when it comes to obtaining research funding and conducting research. The outcome of the competitive advantages of these foreign centres is cooperative, further widening the gap with the CSIC in terms of competition for scientific research, in terms of both funds and results. As for other research institutions trying to remain internationally competitive, this constitutes a serious threat for the functioning of the CSIC, –given that the international sphere is the only one that counts nowadays– it needs to be able to obtain external finance, both from European Union sources and foreign foundations.

The difference between the CSIC and centres in other countries does not lie in the quality of its researchers, as on this level the CSIC is highly competitive, but in its internal management procedures. The operational restrictions imposed by the legal framework for the activities of central government departments and bodies neither envisages nor takes into account the special characteristics of research work. This means that the systems for hiring staff, managing and adjusting budgets, acquiring equipment, etc. are not matched to the dynamism and flexibility required by scientific research today, given that it is increasingly globalised and demands a rapid response tailored to each individual case.

- **Loss of internationalisation of science at the CSIC**

  Along the same lines as described in the previous section, the CSIC suffers from the excessive rigidity of its internal functioning, making it difficult to open up to the international research world, which is the only forum for top quality research. This situation is revealed more powerfully in the case of foreign researchers joining the CSIC, as problems arise from the institution's rigid hiring system and the impossibility of offering researchers from outside the EU a permanent position as a public service. These difficulties and restrictions on the functioning of the CSIC constitute a serious threat to it that could lead to its being relegated to a minor role in European and international science. Signs of this include, for example, the scant institutional presence of the CSIC in the definition, decision-making and monitoring bodies of the European Union's Framework Programme and other major international projects.

- **Lack of motivation in industry**

  Spanish industry lacks confidence and motivation to invest in Spanish science and technology research. This situation appears to have been improving lately, however, and it seems likely that programmes such as INGENIO2010 will be able to help a great deal. Nevertheless, the speed at which new technologies are developing and other countries' success in commercially exploiting research results mean that, nowadays, companies look beyond national borders for their industrial development, importing technology rather than developing it themselves or contracting it from Spanish research institutions. This is a threat for Spain's scientific and technological development which must be taken into account in the CSIC's strategy for the years ahead. At all events, the outlook in this area looks good for the CSIC, given

that contracting of research by companies is a growing source of funding for the institution's research work.

WEAKNESSES

The institution's weaknesses are discussed below ordered by the categories in which related concepts and problems are grouped.

Organisational weaknesses

- ***Inefficient financial and administrative management:*** *The response to changes in the scientific and social environment is slow.*
- ***Hiring of staff:*** *Procedures in common with other more static organisations with less complex structures. Difficulties contracting staff, excessive dependence on units outside the CSIC and the Ministry of Education and Science.*
- ***Impractical infrastructure procurement system:*** *Slow, inefficient, and unsuited to scientific research.*
- ***Excessively centralised organisational structure:*** *administrative formalities are slow and inflexible.*

One of the biggest weaknesses of the CSIC as an institution concerns its organisational structure. It is organised in a way that is somewhat archaic and ill matched to the reality of modern research institutions. The main cause of this obsolete, inefficient and in some respects, ineffective, management system is linked to the procedures the institution is obliged to follow. These are identical to those of other national government bodies which are more static, less complex and do not seek to innovate. These characteristics are quite the opposite of those of a scientific research institution, which in order to justify its very existence, must always be moving into relatively uncharted territory. This contrast between a management system developed for more monolithic institutions and the intrinsic dynamism that needs to permeate the internal functioning of the CSIC, constitutes an important weakness of the institution that it is essential to take into account when designing the future plan of action. Otherwise, any initiative to update the institution may run into insurmountable difficulties in implementation.

Although it is possible to identify a variety of arcane aspects of the CSIC's internal management, the most egregious examples of obstacles to the smooth running of the institution's main activity, namely research, may be summarised as follows:

- **Financial and administrative management:** this part of the CSIC's management suffers from serious operational limitations which make it impossible to adapt the CSIC's management to the context of research activity and keep it outside the arena of international science, and now, national science too.
- **Hiring of staff:** the procedures for hiring both temporary and permanent staff are cumbersome. In the case of temporary staff, procedures should be sufficiently flexible to allow personnel to be taken on when required by the research project. However, the process is excessively rule-bound and formal, in ways that are more characteristic of the contracting of planned services than unplanned needs, which habitually arise in cutting-edge scientific research of the type undertaken at the CSIC. In the case of permanent staff, there is almost no possibility of hiring researchers on a permanent basis, thus making it impossible to recruit highly qualified scientists in a flexible way, as they are obliged to apply for a public servant position under the standard system of entrance exams, in a process which involves a delay of at least a year and a half before a scientist can join from the time the idea is first mooted. This situation is worse still in the case of foreign scientists from outside the European Community as they are ineligible for public servant posts and so cannot join the CSIC.
- **Procuring infrastructure:** This is another bottleneck in the CSIC's management. The procurement of infrastructure, even at relatively modest cost, must follow identical routes of procurement as other institutions with much more predictable forms of operation and constraints. The fact that equipment costing over 12,000 euros has to be bought through a public call for tender implies unnecessary extra bureaucracy and delay. This system, which is supposed to offer guarantees and prevent maladministration, is totally unsuited for a dynamic, modern research institution such as the CSIC. The situation is growing worse over time as increasingly the systems for the purchase of inventoriable material are constrained by the straitjacket imposed by the obligation to use the centralised supply system. This always results in less up-to-date equipment being bought, and at higher prices than could be obtained in the normal market.
- **Excessively centralised organisational structure:** Lastly, another drawback of the CSIC's management which weakens the institution's functioning, is the excessive centralisation of

much of its management. In practice much of its management takes place at head office, and its centres and institutes have to process a large number of formalities through the CSIC's central services. This hinders and slows down the institution's day-to-day management. In the last few years a process of decentralisation has begun, with the transfer of certain responsibilities to the management of the individual centres and institutes. These initiatives need to be stepped up, with even greater delegation of those functions which can be performed more rapidly and efficiently close to the actors most directly concerned, namely the staff at each centre and institute.

Weaknesses in terms of Competencies

– ***Hierarchical dependence on a single Ministry:*** *Other ministries jealously guard their areas of competence.*
– ***Lack of independence in decision-making***
– ***Inadequate coordination with the Autonomous Regions***
– ***Susceptibility to political vicissitudes:*** *Hinders long-to-medium-term planning*

As was mentioned in the «Threats» section, an important weakness of the CSIC relates to its competencies as an independent organisation, as for some years the scope of its competencies has gradually been diminishing. This draining away of the CSIC's competencies weakens its position in the national R&D scene, despite the fact that on the national and international science stage it has managed to retain its image as a solid, consolidated benchmark institution. The loss of the CSIC's competencies is due to a number of factors, which are summarised below.

- **Hierarchical dependence on a single Ministry:** The institution's dependence in the hierarchy on a single ministry, namely the Ministry of Education and Science under the current legislature, is an important factor in the CSIC's loss of competencies. In this framework, other ministries jealous of their competencies, restrict, favour or at least facilitate participation of their organisations and dependent institutions in their R&D policies. Clear examples of this are the series of actions promoted by the Ministry of Health and Consumer Affairs, the Ministry of Agriculture, Fisheries and Food, and the Ministry of Industry and Energy. Their research programmes are designed without taking the CSIC into account, despite the fact that it is the country's most important organisation for research issues. On

occasions the state then intervenes too late to solve problems which have had an impact on the media or society. The weakness of these Ministries in scientific research and technology development topics is evident. Moreover, it is comprehensible, when on many occasions they attract the CSIC's scientists to build their activities in the sector in question, which in turn represents a serious threat for the CSIC, as alluded to in the "Threats" section.

- **Lack of independence in decision-making:** This is in part a consequence of the loss of competencies, but also a perverse effect that reinforces this loss of centrality of the role the CSIC should play in Spanish science. In recent years, as a result of the decline in the competencies of the CSIC, the institution has lost weight in decision-making that directly affects it and, by extension, Spanish science (it should not be overlooked that the CSIC's science accounts for at least 20% of the national total). The best example of the lack of independent decision-making capacity concerns the system for the hiring of staff (for which prior authorisation has to be obtained from the Ministry of Public Administration), preparation of announcements of job vacancies and the recruitment process, modification of budgetary items (which must be approved by the Ministry of the Economy and Treasury), modifications to the list of employment positions, or its centres and institutes (which must be authorised by the Executive Committee of the Interministerial Remuneration Committee, CECIR), etc. Despite the serious effect this lack of independence has on the CSIC's functioning, it is a problem that is difficult to solve within the current administrative structure and which must be taken into account when designing any strategy for the future of the institution.

- **Inadequate coordination with the Autonomous Regions:** The CSIC's problems of competencies vis-à-vis other ministries and institutions are also present at the level of municipal and regional bodies. Once again, the Autonomous Regions, some more than others, ignore the CSIC and fail to exploit the broad experience and global coverage that the institution has as the largest R&D organisation in Spain. In effect, perhaps due to competencies between autonomous regions and as transmitted effect of the lack of coordination between the autonomous regions and the state, the CSIC, as the institution with national scope and spread, finds its possibilities of action undermined, both as a performer of R&D and in the making

of decisions and drawing up of local science and technology policies.

- **Susceptibility to political vicissitudes:** Practically all the deficiencies in terms of competencies described in the paragraphs above can be summarised in the CSIC's susceptibility to political vicissitudes. Without belittling the importance of problems that are short-term or localised, the research conducted by the CSIC as a cutting-edge scientific institution takes in the resolution of global problems, which have an international impact and apply globally. Issues such as cancer, climate change, new energy sources, the origins of man and society, the evolution of customs and cultures, new materials, nanotechnology, functional foods and dietetics, emerging illnesses, cardiovascular problems, the intimate structure of matter and the physical world, etc. are problems and challenges for humanity as a whole. As such, science and scientific research must address the solution of these problems and overcome these challenges in a global, transcultural and politically integrated way. This is how the scientific community operates, independently of ideas, beliefs, ideologies and the prevailing political powers. And although scientific research should not and cannot stay on the margins of society and out of touch with its leaders, it is also true that on many occasions it is used for electioneering purposes only to be forgotten later in favour of other priorities. The final result is that research is excessively dependent on the political winds, which when they blow in the institution's favour, can help it along, but when they do not, they leave it to languish. In the case of the CSIC, these effects, which are common to all scientific research, are yet more evident and a lot of the institution's efforts are absorbed in convincing political leaders of something that is so obvious that it is sometimes difficult to see.

Weaknesses of Participation

– ***Limitations on scientific personnel's participating in companies and other institutions:*** *Exclusive dedication. Compatibilities.*

– *Scant presence of the CSIC at university postgraduate level: Difficulty of recruiting predoctoral students.*

Another of the CSIC's weaknesses concerns constraints on its ability to participate, either as an institution or its staff individually,

in actions strongly related to its main activity, namely scientific research. Thus, the CSIC and its staff come up against limitations on their participating in actions relating to the exploitation of research findings, know-how, and even in training and vocational activities. The main difficulties in this regard are summarised below.

- **Limitations on scientific staff's participation in companies and other institutions:** This is a limitation on the CSIC's staff that is linked directly to the Law on Incompatibilities, and the fact that the institution's scientific personnel are public servants. This is an important limitation as it prevents entrepreneurially inclined researchers from exploiting the results of their research work more directly. As a result, many of these research findings go unutilised by the productive sector and, in short, fail to benefit society. The Law on Incompatibilities limits the activities of public servants to teaching and training tasks. This cuts short many of the initiatives of this kind that researchers might consider. Other countries, such as France, which have a similar public service structure to Spain, have been able to react to this loss of a potential source of motivation for its researchers by relaxing the legal measures preventing their involvement in companies. It is perhaps the time for awareness to be raised in Spain too, and for similar measures to be put in place for its researchers.
- **Scant presence of the CSIC at university postgraduate level:** This difficulty is directly related to the loss of the CSIC's competencies and the threat of «Exclusion from academic environments» alluded to above. Indeed, the legal framework defined by Royal Decree 56/2005, 21 January 2005, regulating official university studies at post-graduate level limits the activities of the CSIC and its scientific personnel to postgraduate training. This has been discussed more extensively in the section on Threats (exclusion from academic environments and often participating only as «guests»), and readers are referred to that section. It suffices here to highlight the weakness these initiatives originating in the academic environment which underutilise the qualifications of the CSIC's staff to train researchers, imply for the CSIC.

Structural Weaknesses

– Limited independent budget for research: Lack of programming of focused research

– High average age of the workforce
– Inadequate infrastructure: lack of space, poor maintenance of equipment and buildings, etc.
– Insufficient technical and management personnel
– Small numbers of foreign researchers
– Lack of critical mass
– Few cross-cutting actions between different scientific areas of the CSIC
– Lack of coordination on dissemination activities
– Low internal profile of technology transfer

In addition to the organisational weaknesses alluded to, and those largely due to circumstances beyond the control of the institution, the CSIC also suffers from a number of structural weaknesses. These are related to the past evolution of the institution, which on occasions has undergone anomalous growth in some sectors relative to others, leading to the institution's current situation. These weaknesses may be summarised as follows.

- **Limited independent budget for research:** This is a significant shortcoming which has a powerful effect on shaping the institution's ability to intervene in the research being conducted in it. The CSIC currently has only limited ability to finance research out of its own budget. The funds available to it are basically those of the in-house frontier projects (*proyectos intramurales de frontera,* PIF). However, the budget for this programme is very limited and can only meet the needs of a small number of projects. It is important that the CSIC have adequate funding to be able to support the baseline research of its research groups. This would give budgetary stability to those groups which, on so many occasions, are in precarious research funding situations. However, at the present time, the shortage of these funds for research represents a serious weakness of the CSIC.
- **High average age of the workforce:** Another negative feature of the CSIC and a cause for concern is the high average age of its research staff (see table 3.8 and figure 3.5). The table also shows the average age of the new tenured scientists who joined the CSIC during the last round of recruitment (2005). It can be seen that although the average age is below that of the average for the institution's tenured scientists as a whole, the values are not so different if we take into account the fact that

one group are new joiners and the other staff who have already been employed on this scale for some time. This indicates that not only is the age of the scientific workforce high, but the age at which new scientists join it too. Although the minimum ages at which new scientists join the institution are noticeably lower, it is clear that the institution's demanding entrance requirements and the historical scarcity of posts combine to bring about this situation.

The high average age of the CSIC's workforce means that the institution's scientists, on average, are not at an optimal age in terms of productivity, and above all, originality and capacity to innovate, which are considered to be highest before the age of 40.[8] It is therefore clear that the average age of the research staff is excessively high, which represents a weakness for a research institution that aims to be a benchmark for excellent pioneering research.

TABLE 3.8

AVERAGE AGE OF CSIC RESEARCH PERSONNEL

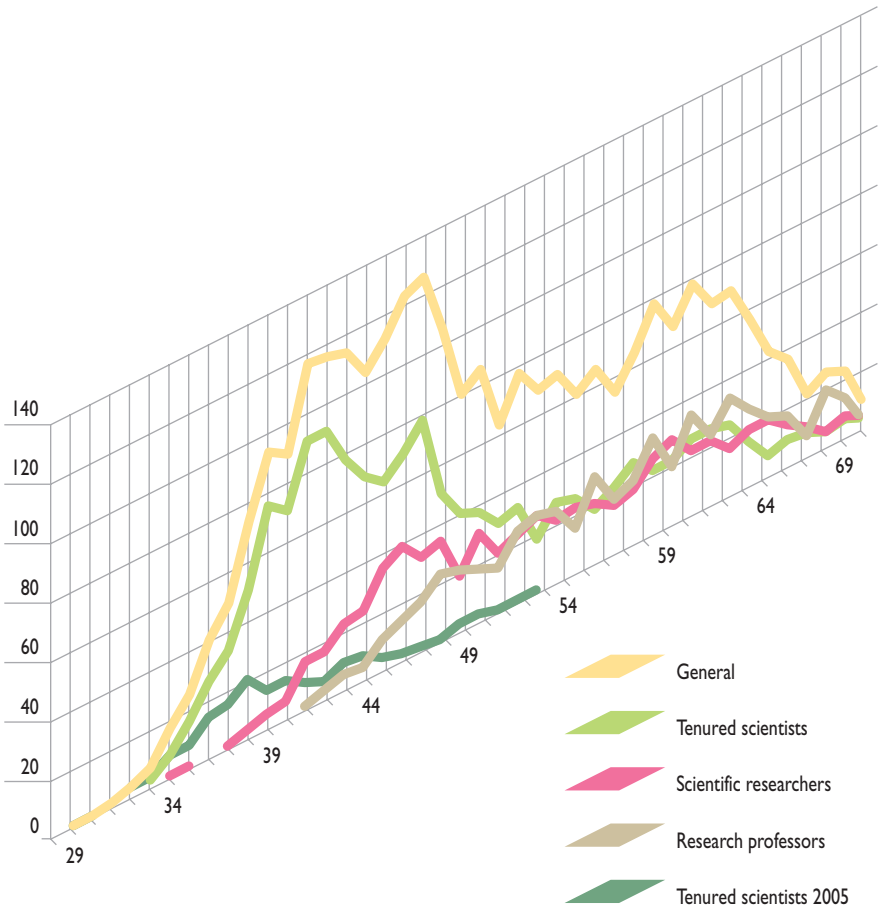
	TS	SR	RP	Total	TS (2005)
WOMEN	47 (31)	52 (39)	58 (45)	49 (31)	40 (32)
MEN	47 (31)	53 (34)	57 (41)	51 (31)	38 (29)
Total	**47** (31)	**53** (34)	57 (41)	50 (31)	39 (29)

TS: Tenured Scientist; SR: Scientific Researcher; RP: Research Professor. The average age is shown in black. The minimum age in each scale is shown in brackets.

- **Inadequate infrastructure:** The CSIC is relatively well equipped and its scientific equipment is fairly up-to-date. This, however, is only true in comparison with other national institutions. When the CSIC is compared with other international research centres the assessment changes radically. One of the main problems in this regard is that there is a longer delay in modern, latest-generation equipment's reaching the CSIC's centres and institutes than in reaching equivalent centres in other leading countries in international scientific research. This has the consequence that it causes a delay in the research activity that the CSIC's scientists can undertake, with a clear loss of competitiveness. It is also true that the CSIC has a set of unique facilities that place it in the lead in many areas of research in comparison with other European countries.

[8] Paula F. Stephan, Sharon G. Levin. *Striking the Mother Lode in Science: The Importance of Age, Place, and Time.* 1992. Oxford University Press.

FIGURE 3.5.
AGE DISTRIBUTION OF CSIC RESEARCH PERSONNEL



However, in many cases this is not due to pro-active actions by the Spanish science and technology system, but accidental circumstances. For example, the Doñana Biological Station has exceptional characteristics for research into ecology, animal communities, etc. Similarly, the location of Calar Alto has excellent qualities for astronomical observation, which is why the Hispano-German observatory was built there. Nevertheless, these unique facilities (both of the examples mentioned being managed by the CSIC) are not the result of efforts aimed at promoting scientific research. It is essential to recognise and assess the suitability of the authorities responsible for financing scientific research's promoting these geo-climatic environments.

Also related to the issue of the inadequacy of the CSIC's infrastructures is the fact that it also suffers a shortage of civil engi-

neering works for its research, e.g. laboratory space, institutes, etc. At present almost all of the CSIC's institutes and centres are at 100% occupancy levels. Even the CSIC's newest centres have high occupancy rates. This represents a serious obstacle to growth and is a constraint on the recruitment of new research staff, which the institution nevertheless needs. This lack of space is a weakness of the institution that needs to be corrected by creating new institutes and expanding some of those that already exist. In this sense, the state of conservation of some of the CSIC's buildings is a cause for concern, and in some instances their condition is even dangerous. It is necessary to repair some of the older buildings as a matter of urgency, either by replacing them with new buildings or by refurbishing and remodelling those that exist.

- **Insufficient technical and management personnel:** The distribution of the CSIC's staff by functions is highly asymmetrical. Thus, whereas the research staff comprises 3,202 researchers and 3,806 doctoral research fellows, the research support staff consists of only 3,626 employees and 1,040 management staff (See table 3.9). This distribution of human resources is atypical among comparable international research institutions (See table 1 in Strengths). Thus, whereas in the CSIC the ratio of support personnel to research personnel (S/R ratio) is 0.52, in other counterpart European institutions this ratio tends to be higher (Max Planck: 1.46; CNRS: 1.24; CNR: 0.61).

  The main effect of the CSIC's lower S/R ratio is a reduction in the institution's research capacity. Indeed, research is highly dependent on highly qualified technical personnel able to perform the experiments designed and interpreted by the research staff. When there is a shortage of technician support, the research staff has to dedicate part of its time to tasks for which it is over-qualified. This means resources are underutilised, which has a negative impact on results. A similar situation occurs in the case of management staff, who are responsible for the administrative and management workload linked to performing research. Although the CSIC's management personnel is extremely well qualified in general and well prepared to handle even the complex management entailed by European projects, they are too few in number, at times giving rise to serious management shortcomings which have to be compensated for by researchers themselves. On the institutional level, the CSIC's central organisation is understaffed with management person-

TABLE 3.9

DISTRIBUTION OF CSIC PERSONNEL BY FUNCTIONS

Numbers of employees by roles	
Research support	3,626
Management	1,040
Maintenance	805
Research	7,008
Total	**12,479**

Data as at April 2006.

nel, thus seriously constraining the possibilities for growth in the institution's activities.

- **Small number of foreign researchers:** This is an important weakness of the CSIC, which is largely due to the current staff hiring systems. However, it is also a result of the low international profile of the institution on this level. Thus although the CSIC enjoys a good image abroad, the organisation is still not viewed by foreign researchers as a potential destination. Moreover, as already mentioned, researchers who do take the initiative to approach the CSIC come up against a whole range of legal difficulties in the way of their joining the research staff. It should be reiterated, however, that many of these obstacles are due to restrictions on the CSIC and its lack of competencies over the hiring of staff, rather than weak management of this area. This situation is outside the guidelines promoted by the European Union with a view to increasing the mobility of research staff and encouraging interaction between the countries of the EU. Foreign researchers' joining the CSIC would undoubtedly bring benefits to the institution, which to date has depended almost exclusively on Spanish researchers. Researchers from abroad would bring to the institution different points of view, ways of working and new ideas arising from the interaction with other scientific, academic and social spheres, thereby enriching the research undertaken at the CSIC. The importance of foreign researchers for the progress of science and research has been recognised by institutions in other countries.[9] Intensive efforts to bolster this area of weakness must be made a priority in the CSIC's framework of action if the institution is to achieve the vision it proposes.
- **Lack of critical mass:** This weakness is associated with the CSIC's overall shortage of research staff. As in many activities and processes, all fields of research need a certain critical mass of researchers in order for the lines of research to be able to progress. It is self-evident that scientists working in an area in which there is a shortage of researchers will have enormous difficulty in making progress in their research relative to those working on better established topics. Even in these cases, the limited number of research staff in some of the CSIC's institutes means that it is difficult for them to find a common place

[9] For example, this point has been made in the document entitled *«Policy implications of international graduate students and postdoctoral scholars in the United States»* published in 2005 by the US National Academy of Sciences.

in which to exchange ideas, and where they can debate, discuss and solve research problems. This is only possible when there are sufficient researchers to allow this kind of exchange of experience. Also, as is well known, when a threshold is crossed in the numbers of scientists working on topics with common areas of interest in close proximity with one another, synergistic effects can arise. The results that may be achieved are greatly multiplied and undoubtedly much greater than the sum of the individual efforts. The lack of critical mass is most obvious in topics and lines of action outside of the main flow of research, which are, however, in some instances, the most innovative. The way to put right this weakness is simple: increase the number of staff.

- **Few cross-cutting actions between different scientific areas of the CSIC:** Although the CSIC is a multidisciplinary research organisation in which almost all areas of knowledge are addressed, the level of interdisciplinarity remains low. This is not only related to the research culture of its scientists, where the tendency over many years has been towards ultra-specialisation, thereby creating areas of knowledge that are more or less isolated from one another, like a bad implementation of the areas of university knowledge, but also the limited possibilities for interaction between areas that the public research funding system allows for. This tendency has begun to change in recent years, with a shift towards a research funding scheme that is closer to the idea of «doing research on a problem» than «doing research in an area of knowledge.» As mentioned in the section on «Strengths», the CSIC has promoted the interaction and fusion of different areas of knowledge, and in the mid-80s it created the Materials Sciences and Technology and Food Sciences and Technology areas. From today's perspective it is possible to see that the decision was a wise one. Moreover, in an attempt to promote this type of interaction between areas, three years ago the CSIC created the In-house Frontier Projects (*Proyectos Intramurales de Frontera,* PIF) which were also discussed above. These actions have always been well received, particularly by the more entrepreneurial researchers, and they have produced good results, as has been seen over the medium to long term. However, the research environment at the CSIC (and in almost all Spanish research institutions), is still much to tightly constrained to artificially defined areas of knowledge. This is a weakness of the CSIC that, unlike others discussed here, could be rectified through pro-active measures by the institution, and

therefore, these should be taken into account in the design of the CSIC's future strategy.

- **Scant coordination on dissemination activities:** One of the CSIC's functions and obligations, as a public research institution, relates not to conducting scientific research, which is its main activity, but to making scientific knowledge and the culture of research known to a wider audience in society. In 2004, aware of the importance of this task, the CSIC set up a Scientific Culture Area responsible for these functions and whose goal is to bring science closer to the public, and ensuring that researchers interact with the society they live in, as it is society which pays for the scientific research they do, and society whose problems and challenges it is their task to solve. The positive response by the public to scientific outreach initiatives is proof that this role's moment has come and reveals the precarious situation in which Spain's set of research institutions traditionally finds itself. Even though the task of popularising science and bringing it closer to the public is being bolstered in the CSIC, it still falls short of what might be desirable, and constitutes a weakness of the institution which, as in the previous case, could be rectified by internal decisions. One of the problems relating to this weakness is the general lack of coordination among the CSIC's outreach activities. Even though there is a central body whose purpose is to integrate these activities, i.e. the Scientific Culture Area, many research activities at the CSIC's centres and institutes continue to be carried out without coordination with this area. This reduces the effectiveness of these outreach activities and affects the institution's public profile.
- **Low internal profile of technology transfer:** There are two main aspects to the social justifications for science and research. On the one side, it gives answers to people's questions and satisfies their curiosity about their origins and workings, and by extension, the origins and workings of the world and the universe. On the other side, there is the more utilitarian justification that science and research should provide solutions to humanity's and society's problems and enable technological progress. These two reasons for science in society are given differing weightings in the minds of scientists and researchers, depending on the kind of research they are doing. However, in many cases, scientists' personalities, which are what lead them to organise their lives around scientific work, are closer to the

first mission of science than the second. This results in researchers often being remote from the practical utility of their research. In the CSIC, despite its being Spain's top research institution in terms of technology transfer and the use of the knowledge it generates, the technology transfer potential of the research undertaken has limited visibility. Although there are exceptions, the CSIC's researchers are generally unaware of the institution's potential to exploit the knowledge it generates commercially and obtain revenues from research results. This ignorance has a very negative effect on all aspects of technology transfer by the CSIC and is a weakness that needs to be put right. The number of patents, utility models, research contracts with businesses, spin-off firms set up, etc. should increase if measures are carried out to bring technology transfer closer to researchers and encourage a more business-oriented mind set.

OPPORTUNITIES

The opportunities foreseen that the CSIC might utilise to design its strategy for the next four years are of various types. These are summarised below.

Scientific Opportunities

– ***Horizontal (inter-disciplinary) research:*** biomaterials, biofuels, biosensors, etc.

– ***New scientific niches:*** stem cells, etc.

Among the opportunities the CSIC's environment offers it for its development, the most significant regarding the institution's vision and mission are those of a scientific nature. These opportunities are international in scope, which is the only level on which science is possible in today's world. These scientific opportunities basically fall into two groups: cross-cutting (inter-disciplinary) research and new, under-explored topics of research.

- **Cross-cutting inter-disciplinary research:** As mentioned earlier in this SWOT analysis, today's science needs interdisciplinarity in order to continue making progress on knowledge generation and responding to mankind's needs and problems. The classical divisions of knowledge have become obsolete and, except in the case of more recent and less well established sciences (such as biology, computing, etc.), the majority have for some

time been facing problems and challenges that go beyond their traditional borders. This is the case of chemistry, for example, which has developed towards problems which overlap with other sciences such as physics (materials science), biology (biochemistry and structural biology), etc. This new way of doing science is characterised by the interdisciplinary approach to problems and research challenges. Although for some time there have been research groups in various areas –in the CSIC and elsewhere in Spain– working on solving research problems, in many cases this collaboration has not gone beyond the sphere of experimental methodology and is more a case of multi-disciplinarity, i.e. bringing together methodologies from various different areas of knowledge, than interdisciplinarity, understood as the conceptual marriage and hybridisation of different disciplines so as to generate new concepts that did not previously exist and which are not common to any of the disciplines on its own. Interdisciplinarity is the goal to pursue here, as it is in this fusion that new ideas and paradigm shifts can take place, leading to real progress in knowledge and technology. Areas such as biomaterials, nanoscience, nanotechnology, biofuels and biosensors are interdisciplinary areas with a clear future in the technology field. Systems biology, archaeology of the landscape, palynology, artificial intelligence, etc. are examples of interdisciplinarity in the conceptual sphere. The CSIC needs to be able to utilise and exploit the multi-disciplinarity that characterises it so as to transform it into interdisciplinarity and lead research in Spain in these frontier areas. This is an ideal opportunity for the CSIC and one which cannot be exploited as effectively by other Spanish research institutions. It is therefore almost the CSIC's duty to society to incorporate inter-disciplinarity into its vision.

- **Under-occupied scientific niches:** The other generic scientific opportunity that the CSIC could exploit in the years ahead are the new scientific niches that have opened up recently but are still relatively unoccupied. Research on topics such as stem cells, bionics, quantum computing, astroparticle physics, etc. are new fields of research that are at very early stages and in which it is still possible for new discoveries to be made which are of scientific, and clearly, technological, significance.

Financial Opportunities

– **Socio-economic demand for science and technology results**

– **New national research-focused programmes: INGENIO2010**
– **New scientific programmes run by the Autonomous Regions**
– **New incentivisation policies for spin-offs and start-ups.**

Like any other research institution, the CSIC needs adequate funding systems to run its activities and fulfil its mission. For this reason, the financial opportunities that exist at national, European and international level need to be taken into account in the strategic design of the institution's action plan for the coming years. At national levels there are various opportunities for research funding and for the exploitation of scientific results. These can be summarised as follows:

- **INGENIO2010:** The conclusions of the 2000 Lisbon Strategy highlight the importance of a knowledge-based economy to the growth of the EU's economy and to making it competitive against the world's leading economies, namely the United States and Japan. The Lisbon Strategy mentions a number of actions EU countries need to take to reduce this deficit in their competitiveness. Among other things, EU countries need to encourage the participation of business in scientific research, so as to reach a stage where the private sector is responsible for 50% of research funding. The actions it envisages also include an increase in research investment up to a level of 3% of GDP in 2010 and increasing the number of researchers in the EU to 700,000. These indications provide excellent opportunities for the development of the CSIC and other research institutions. In effect, at both European and Spanish levels there are a wide range of initiatives underway to promote research. At the national level, the current government has designed and implemented the INGENIO2010 programme, which includes various research-related actions and offers of funding which the CSIC needs to take advantage of to develop its strategy over the years head.
- **New scientific programmes run by the Autonomous Regions:** Spain's Autonomous Regions are also running initiatives with a view to promoting scientific research. In line with national research promotion policies aiming to develop the knowledge-based economy, the Autonomous Regions offer funding opportunities and optimal research niches for the CSIC, given its multidisciplinary and multi-sectoral nature. In each Autonomous Region the funding plans and instruments are defined by the region's specifics and they tend to focus on studying and developing topics relating to the productive sectors or natural resources of the region. Only a few of the

Autonomous Regions, such as Madrid and Catalonia in particular, and to a lesser extent Andalusia and Valencia, offer more general programmes which cover almost all areas of research. In both cases, the CSIC, thanks to the variety of the lines of research it covers, its scientific rigour and experience in the management and performance of research projects. It is an excellent recipient for both specific and general regional research policies.

It is important that the CSIC overcome the threats discussed above regarding its interaction with the Autonomous Regions and that it not find itself excluded or marginalised in its participation in regional research programmes.

- **Socio-economic demand for science and technology results:** It has been traditional for manufacturers and other firms in Spain to buy their technology from outside rather than develop technology of their own. This is so because buying other people's technology gave a better return on investment, at least in terms of the time taken to implement it and the opportunity cost. This is part of the reason for Spain's being behind in technology and, above all, innovation. However, this seems at last to be changing. Over the last decade there has been a noticeable trend in the research world in Spain towards obtaining a profit from the results of research. The number of patent applications has increased substantially compared to previous years, as have the numbers of spin-offs and start-ups. This renewed entrepreneurial spirit in the scientific and research world has begun to percolate through to business and companies are starting to review their strategies for updating their technology and looking to the national research market. This is clear in the case of the CSIC. Indeed, in the last few years it has been possible to see a noticeable increase in the amount of research contracted by both state-owned and private companies. This trend in the exploitation of the results of research has gained new momentum with the emergence of venture capital and seed capital firms originating in public research institutions. Technology parks have also been set up for the first time, as a means of bringing business investments closer to research centres. In this respect, the CSIC should pay attention to avoid being excluded or left out of these initiatives, in which the universities and other research bodies appear to be participating more actively.

  As well as the demand from industry and firms for utilisable research results, there is also a growing demand on the part of so-

ciety that requires science and researchers to address and solve the problems that concern them. In general, society respects scientists and they have a good image of their honesty. It is necessary to ensure that taking advantage of this opportunity does not harm the positive view society has of science. This is an ethical imperative, and essential if this favourable atmosphere for scientific research is not to be squandered.

- **New incentivisation policies for technology-based spin-offs and start-ups:** The creation of technology-based firms is particularly appropriate when the need exists to transfer a significant amount of tacit knowledge or when the «receptive capacity» of the market, particularly locally, is low. This low level of receptiveness may be due to the research result's being insufficiently developed, and a technology-based firm is the ideal environment in which to mature it into a commercial product.

  The creation of technology-based firms brings benefits in terms of the generation and regeneration of high value added industrial fabric which is sensitive to R&D, creates high quality jobs and local wealth. As a result of the intrinsic characteristics of technology-based firms, the capacity to absorb the results of technology from public research centres and the demand for their services and technologies increases. Moreover, for the institution generating them it implies the creation of an image of the institution in the eyes of players in the productive sector that is one of solidity and value.

  It is also a good instrument for bringing together the public and private spheres. In effect, the dynamics of creating and developing technology-based firms involve a meeting of public intellectual capital (i.e. researchers) with the entrepreneurial capabilities of business people, the productive capacity if businesses, and the capital per se of financial institutions.

  For all the above reasons, the creation of technology-based firms has been identified and given priority in the Lisbon strategy and on the political agenda of national, regional and local governments (it should not be forgotten that companies are generators of local wealth and technology-based firms provide high added value in terms of the types of employment they create and the level of investments they attract). Almost all these levels of government have programmes dedicated to incentivising the creation of technology-based firms and have funds for feasibility studies and specialist professional advice.

Worthy of note in this regard is the CDTI's NEOTEC programme, the activities carried out by the *Fundación Genoma España* in the field of biotechnology and the venture capital fund for the university system, *I+D Unifondo*, which is managed by *Uninvest*. Private institutions, such as banks and savings banks, are also involved in these efforts. Altogether, it can be said that there is a significant volume of seed and start-up capital in the market which is available to newly created technology-based firms.

Socio-political Opportunities

- ***«Observatories» of social and political interest:*** sustainability, immigration, climate change, etc.
- ***Lisbon agenda:*** towards a European knowledge-based society
- ***Eagerness of the educational sector for high quality popular science programmes***
- ***Specialist Masters' courses***
- ***Moment of change in central government administrative structures***

Since the restoration of democracy in Spain there has never been a time when there has been as much emphasis on science and research as today. Up until the nineteen sixties science was seen in Spain as being something marginal, arcane and remote from society, which was more concerned about more immediate, pressing issues than technological and scientific independence. Research was organised around outstanding figures, with powerful groups that concentrated the scarce resources devoted to science in their hands. It was in the dark days of 1939, shortly after the end of the Spanish Civil War, that the CSIC was created out of the *Junta de Ampliación de Estudios e Investigaciones Científicas* (Council for Scientific Research and the Extension of Studies), the *Fundación de Investigaciones Científicas y Ensayos de Reformas* (Foundation for Scientific Research and Reform Trials) and the *Instituto de España* (Spanish Institute). Later on, in the sixties and seventies, science and research came to be seen as something mysterious, evocative and awe-inspiring, which was seen from afar, remote from life in Spain, as something unattainable in Spain, in the hands and minds of other countries. It was in the eighties that civil society and policymakers in Spain began to realise that quality science and research was also possible here, without it being necessary to import it all from abroad. Now, after these years of

consolidation of the national R&D model through the National Plan, we are at a point where the environment is right for science and research to really take off in Spain, and move up to the level where it can address the problems and concerns of human curiosity.

More importantly still, this feeling is not limited to the scientific environment, where it has always existed and been promoted, but is widely shared across society, the economy, and of course, in policy-making circles. Moreover, the globalisation of these sectors being driven by integration with the European Union is bringing them close contact with the globalisation and universality of science, which has an amplifying effect on the support society gives to research and knowledge. This has been given shape in a range of European Union documents, such as the road map defined by the Lisbon Conference for the future development of the EU's member states. Under the umbrella of these agreements a number of different initiatives of various types have emerged, which constitute genuine socio-political opportunities for progress and which the CSIC can and must exploit in the strategy defined by its Action Plan. These include, among others:

- **"Observatories" of social and political interest:** For a long time societies have been moved by ideologies and discourses of scant argumentative value. Fortunately, however, society is increasingly well informed and although the public inevitably remains susceptible to manipulation, people demand more study and analysis of issues that affect them and which underlie the government's policies of action. In response to these demands a variety of «observatories» have been set up looking at issues of concern to society which require objective knowledge for policies to be designed and solutions put forward. Topics such as immigration, climate change, sustainable development, energy, etc. are matters of concern to society and have spurred the creation of observatories to monitor and study them. The CSIC has a good opportunity to participate in these observatories and platforms by contributing its theoretical and technical knowledge, human resources and the infrastructure necessary to give content and substance to these initiatives.
- **Lisbon Conference on the European knowledge-based economy:** As mentioned above and in other sections of this SWOT analysis, the Lisbon Conference laid down the guidelines for the development of the EU's member states towards a knowledge-based economy. The Lisbon agenda sets out clear targets and

measures to be taken in order to achieve a level of 3% of overall GDP in the EU being devoted to R&D by 2010 and a notable increase in the number of researchers. As with other European initiatives, the Spanish government has adopted this legislative framework and has begun to implement programmes to bolster public and private research, offering exceptional opportunities for development of the CSIC's strategy in pursuit of this vision.

- **Eagerness of the educational sector for high quality popular science programmes:** Teaching and education are without doubt issues of the utmost importance for the future of any country. As is to be expected, Spanish society is concerned about the education of future generations and demands quality educational programmes. Although education and teaching are not the primary goals of the CSIC as a research body, they should nevertheless be considered to form part of its duty to society. Indeed, the CSIC is an excellent generator of knowledge and has a duty to bring this knowledge to society. There is demand from education professionals for popular science activities to bring science and research into schools. Schoolchildren are at a receptive age at which their decisions and preferences over their future professional direction are still being moulded. It is therefore a priority to nourish these sectors with quality dissemination programmes of which there is a clear lack in Spain. The CSIC can exploit this opportunity by filling a market niche that is virtually empty. This would enable it to fulfil its social obligations and, at the same time, it would considerably raise the institution's profile.
- **Absence of a national market in specialist masters' courses:** Along the same lines as the preceding section, in the Spanish educational sector today there is a clear shortage of good quality highly specialised and masters' courses on science and technology subjects. The CSIC should leverage its considerable collective know-how by offering specialist masters' courses of types not currently available and which are likely to be well received by the business and industrial market.
- **Moment of change in central government administrative structures:** An additional opportunity for the CSIC at the current juncture is the change taking place in the administrative structures of national government. As mentioned repeatedly over the course of this analysis, many of the CSIC's problems arise out of its current administrative structure, which is subject to cen-

tral government's regulatory framework. However, the recently passed Law on State Agencies (*Ley de Agencias Estatales*) offers a unique opportunity to try to improve the CSIC's administrative constraints to some extent.

Staff Opportunities

– **New programmes to create incentives for the contracting of scientific staff**: Ramón y Cajal, I3,…

– **New, well trained researchers**

The opportunities presented by the current environment in terms of personnel, together with opportunities of a scientific nature, are of particular importance as they are aimed at the most important factor in the science and technology system, namely human resources. These staff opportunities are basically of two overlapping types: funding (contracting) and recruitment. Both will be briefly discussed below.

- **New programmes to create incentives for the contracting of scientific staff:** Approximately five years ago the Ramón y Cajal programme was set up to hire post-doctoral researchers with demonstrable high quality experience. This programme, together with the *Fondo de Investigaciones Sanitarias* (Health Research Fund, FIS), has provided a mechanism whereby young researchers have been able to join the Spanish research system under conditions that enable them to start to develop their scientific careers as independent researchers, either independently or as members of larger, consolidated research groups. Later a number of other similar programmes aimed at contracting young researchers were set up in Spain's Autonomous Regions: Averroes in Andalusia, Parga Pondal in Galicia, and with notable differences, the ICREA programme in Catalonia. Also, more recently, the Ministry of Education and Science's Juan de la Cierva and I3 programmes have been added to the system to bolster human resources in R&D. These programmes to enable or support (I3 Programme) the hiring of experienced research personnel supplement and add to the programmes for the training of predoctoral researchers (predoctoral grants and contracts, FPI and FPU programmes). This set of initiatives has made it possible for a large number of researchers to join the CSIC, many of whom have gone on to join the ranks of the institution's permanent workforce. Collectively, and specifically, these programmes are an opportunity for the CSIC to boost its research workforce

with young scientists at the most productive early stages of their scientific careers, thus contributing to the necessary generational changeover and lowering the average age of the institution's research workforce. The outlook for these programmes is good and they seem likely to continue, either in their current form or with modifications, in the future. The CSIC should continue to lead the efforts of public research bodies to offer positions to junior researchers as this is the main way in which they can start working in a research environment, and although they need to undergo significant monitoring and assessment, it allows them to be put to the test under real research conditions and the most outstanding scientists selected as future members of the institution.

- **Generations of well trained researchers in the R&D system:** As may be deduced from the preceding section, the years of investment in the Spanish science and technology system have borne fruit in the form of generations of well trained researchers able to undertake quality research, up to the standards of the most important research centres around the world. What is more, in many cases exceptional research at these centres has been the product of the efforts of Spanish researchers during their post-doctoral stage at research centres abroad. The current situation, therefore, is a long way from that in the past when well trained researchers were thin on the ground. Today, although there are serious deficiencies with respect to other countries that are much more competitive in science and technology, there is a pool of well qualified researchers from whom the CSIC is able to select the finest. The opportunities this situation presents should not be let slip away and the CSIC must be able to attract the best of these researchers.

International Opportunities

– ***Presence of the CSIC in International Bodies***

– *Spain as the interface between the **EU and Latin America** in science as well as other sectors*

– ***Cooperating and twining with other research institutions abroad***

– ***The CSIC's presence abroad:** Europe, Latin America, Eastern Europe, USA, Japan*

Science and research cannot be envisaged except in an international context. The CSIC cannot close its eyes to this reality and must

make an effort to expand its sphere of operation beyond Spain's national boundaries. The CSIC must become more international if it is to survive in the highly competitive environment of scientific research of the first order. There are a variety of opportunities in this regard that have to be exploited in order to make progress in this direction and to which insufficient attention is being paid at the present. Some of these opportunities arise out of the process of Spain's integration with the EU and the disappearance of national borders. Others arise out of Spain's unique position as the interface between Latin America and Europe. Yet others exist simply because they are not yet saturated. Some of these opportunities are described below.

- **Presence of the CSIC in International Bodies:** The CSIC must be able to make the most of its participation in international bodies in order to promote the institution's internationalisation. The CSIC currently participates in a number of multinational institutions, such European Molecular Biology Organization (EMBO), the European Science Foundation (ESF), and European Southern Observatory. These raise the CSIC's international profile and open up channels for collaboration with research institutions in other countries. This type of activity must continue to be promoted in the future CSIC Action Plan for the coming years.
- **Spain as the interface between the EU and Latin America in science as well as in other sectors**: The fact that Spain is seen as the natural link between Latin America and Europe is an opportunity that the CSIC should exploit in its internationalisation strategy. As happens in other social and economic sectors, in science and research there are links and interactions with the countries of Latin America. Traditionally the CSIC's research groups have kept up highly active collaborations and exchanges with Latin America. However, at the institutional level collaboration is limited, as is the collaboration of other Spanish research institutions. Given their location, geoclimatological, ecological, historical and social conditions, the countries of Latin America offer exceptional conditions for unique scientific research. The CSIC should make an effort to establish mechanisms for intensive collaboration with Latin America, not just by receiving researchers from these countries, as it has done for many years, but also going in the opposite direction and extending its activities to Latin America. This is an area which has not been exploited by public Spanish research institutions,

although the private sector has been active and has been able to utilise the potential of direct collaboration in situ with Latin America. Although under-explored, this type of direct collaboration activity constitutes a good opportunity for development by the CSIC.

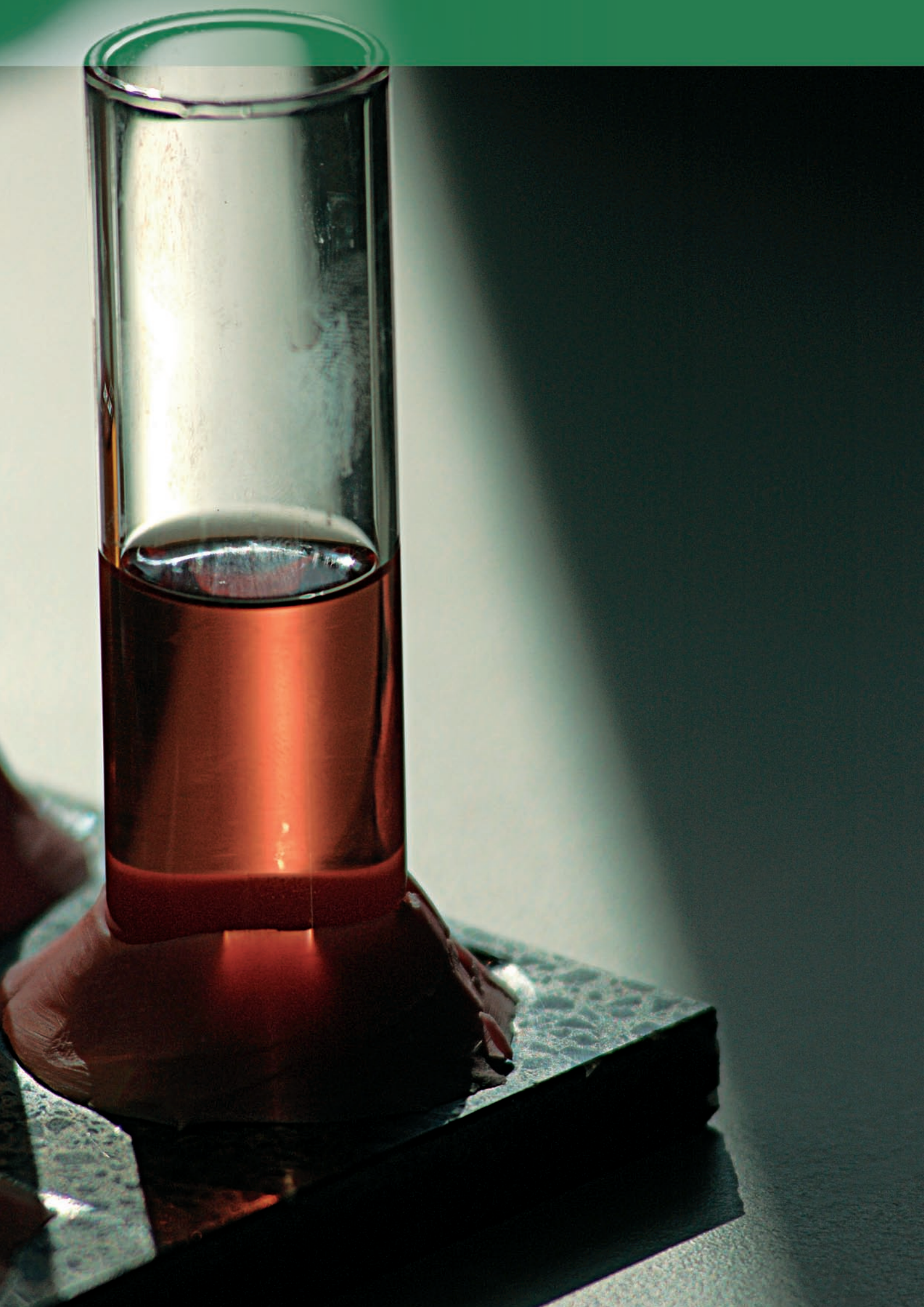
- **Cooperation and twining arrangements with other research institutions abroad:** Another opportunity to expand the CSIC's international horizons arises from cooperation and twining activities with research institutions in the world's leading countries in science and technology. The CSIC can benefit from this type of activity and raise its institutional profile in areas of considerable scientific, technological and economic interest. It is also clear that collaborations between Spanish research groups and those in other countries are bolstered and facilitated if fluid mechanisms of exchange are put in place.

  This type of institutional cooperation is still not widely used today, so offers the CSIC scope for development in an area where it can play a significant role for Spanish science and research. Research institutions in countries such as the United States, Canada, the United Kingdom, France, Germany, Japan, Israel, etc., which are world leaders in research and technology development, are the obvious target for this type of new activity, which to date have consisted of underdeveloped bilateral collaboration agreements. The aim of this new type of activity is to establish special collaboration agreements between the CSIC and institutions in these countries, so as to be able to create a space and a framework for joint activities, with the mutual recognition of researchers, services and installations of both institutions, so as to allow a more fluid exchange between them.

- **The CSIC's presence abroad:** Another step forward in the internationalisation strategy discussed in the preceding paragraphs is to set up CSIC institutes abroad. Having real research sites (rather than local offices or institutional missions) in other countries makes it possible to attract the attention of the scientific community in the host country, opening up the possibility of recruiting foreign scientists with greater ease. This type of activity would enable the CSIC to play in the same field as other institutions with an international standing and facilitate exchanges and collaboration between them. Moreover, the CSIC's image would be bolstered in places where the market is more dynamic and active in terms of the demand for and receptiveness to research and technology. The United States, Canada, Europe

and Japan are clear examples of potential countries in which the CSIC could set up centres of the kind alluded to here.

At the same time, setting up centres in developing countries would allow the CSIC to play a leading role in these countries' scientific and technological development. Moreover, the CSIC's centres in these countries would be a focal point attracting the best local scientists, who are eager for high quality research centres and institutes. The CSIC would translate the benchmark status it enjoys nationally to these countries, with the clear benefits this would imply, such as, for example, being able to access specific development aid, preferential treatment in technology transfer markets, etc. Latin America, Eastern European countries and North Africa are the obvious targets for this kind of action.



4 INTEGRATED ANALYSIS

The preceding chapter described the Strengths and Weaknesses of the institution and the Threats and Opportunities present in the environment in which it operates. This section will analyse each of these elements in an integrated way. To do so, as an initial approach, a cross-over analysis will be performed to examine what each element in the SWOT analysis represents for the others. This procedure involves quantifying (from -3 to +3) of the effect a given item of the SWOT analysis (Strength, Weakness, Opportunity or Threat) has on the other items. In the quantification tables each cell indicates the value assigned to the effect of the element at the top of the column on the SWOT element at the start of the row. The last column of each block of elements indicates the extent to which the element in each row is affected by the set of elements as a whole (Strategic Value of the element). Additionally, the final column of the table summarises the aggregate effect of all the other elements (Overall Strategic Value). This gives an idea of the relative strength of fragility of each element. If this is a strength, a very high value will indicate that it is an element that is relatively unaffected by the weaknesses and threats and thus very useful when exploiting opportunities. By contrast, if the value is low, this indicates that this strength is powerfully influenced by the weaknesses and or threats present and/or is not very useful when exploiting opportunities. Similarly, in the case of a Weakness, a highly (positive) cumulative value indicates that it is a weakness that only has a slight effect on the strategy designed because it is largely offset by the strengths and weaknesses and only slightly reinforced by the threats. By contrast, a very low (negative) value will indicate that it is a serious threat, which must be taken into account when the strategy is designed.

In a similar way, the sum of the values in each column, shown along the bottom row, is an indicator of the accumulated importance of the element in that column in relation to the other indicators in the rows (Synergistic Impact of the element). This value is important in determining the relative effect of each element overall. High values indicate that the element concerned is positive and reinforces a large number of strengths, making it useful in exploiting opportunities, offsetting or cancelling out weaknesses or protecting against threats. A very low, negative, value indicates that the element does not synergise constructively with other elements indicated in the rows. As in the case of Strategic Value, the summary table indicates the Overall Synergistic Impact of

The aim of the **Integrated SWOT analysis** is to identify those elements of the analysis (Strengths, Weaknesses, Opportunities and Threats) that may be of greatest importance when defining the institution's strategy. For this purpose three concepts are defined to facilitate the analysis of each SWOT element:

- Strategic value: this measures the extent to which each element of the SWOT analysis is affected by the others
- Synergistic impact: measures the extent to which each element affects the others
- Strategic importance: this is the combination of each element's Strategic Value and Synergistic Impact and measures its relative importance in the definition of the strategy.

each element. This measures the element's effect on all the other SWOT elements.

Finally, the sum of each element's Strategic Value and the Synergistic Impact gives the degree of usefulness of each element in the design of the CSIC's strategy (Strategic Importance).

Given that the SWOT elements may reinforce themselves (whether positively or negatively) in the integrated analysis each element's effect on all the elements (including itself) is analysed.

ANALYSIS OF STRENGTHS

Table AS.1 shows the effect of each of the strengths identified in the SWOT analysis on the other strengths. The column on the right shows the accumulated value of the reinforcing effect of each strength indicated on the horizontal lines with all the others. This value constitutes the Strategic Value of the Strength, in that it gives an idea of the extent to which this Strength is reinforced by the others and, as we shall see in what follows, how it is affected by the other elements of the SWOT analysis. Strengths with a high Strategic Value are those that benefit from other strengths and are therefore useful when designing the strategy to follow in the future as they will be the most robust. Thus, this phase of the analysis indicates that Strengths S8 (**Technology Transfer**), S3 (**Public Image**), S11 (**Interaction with the technology and industrial sector**) and S4 (**Pool of researchers**) have a high strategic value. By contrast, Strengths S5 and S6 (**Nationwide scope** and **Scientific infrastructures**, respectively) have least strategic value from their interaction with other strengths. It needs to be borne in mind, however, that the Final Strategic Value will be influenced by the extent to which each strength is affected by the other elements of the analysis (Weaknesses, Threats and Opportunities).

The last row shows the accumulated value of the effect of each of the strengths indicated in the upper part of the columns over all the others (indicated on the left of each row). This value is referred to as the Synergistic Impact and it represents a measure of the extent to which each strength synergises with the others, and as we shall see, with the other elements of the SWOT analysis. A higher value of the Synergistic Impact means that a given Strength reinforces more other strengths and/or reinforces them to a greater extent. The future strategy deriving from this analysis must take this fact into account and take care to nurture those strengths that

TABLE AS.1

EFFECT OF EACH STRENGTH ON THE OTHER STRENGTHS

			STRENGTHS											
			S1 Research staff	S2 Multidisciplinarity	S3 Public image	S4 Pool of researchers	S5 Established nationwide	S6 Infrastructures	S7 Technical staff	S8 Technology transfer	S9 European funds	S10 Basic and applied research	S11 Industrial and technological interaction	STRATEGIC VALUE
STRENGTHS	S1	Research staff	3	3	0	3	1	1	2	1	1	2	1	18
	S2	Multidisciplinarity	3	1	0	3	0	1	1	2	2	1	2	16
	S3	Public image	3	3	1	3	3	1	1	2	1	2	2	22
	S4	Pool of researchers	3	3	3	1	3	1	1	1	1	2	1	20
	S5	Established nationwide	0	0	3	2	1	0	0	1	0	0	3	10
	S6	Infrastructures	1	1	2	0	1	1	0	1	1	2	1	11
	S7	Technical staff	2	2	0	1	1	2	1	1	1	1	1	13
	S8	Technology transfer	3	3	3	1	3	1	1	3	1	3	3	25
	S9	European funds	3	3	1	1	0	0	0	1	3	1	1	14
	S10	Basic and applied research	3	3	0	1	0	1	1	3	1	2	3	18
	S11	Industrial and technological interaction	1	3	3	0	3	1	0	3	1	3	3	21
		SYNERGISTIC IMPACT	25	25	16	16	16	10	8	19	13	19	21	

are instrumental to the optimal exploitation of the other strengths and themselves. This would be the case, for example, of Strengths S1 (**Research workforce**), S2 (**Multidisciplinarity**) and S11 (**Interaction with the technological and industrial sector**). In line with this last point, strengths S8 (**Technology Transfer**) and S10 (**Interaction between basic and applied research**) also show high Synergistic Impacts. At the opposite end of the scale, strengths S7 and S6 (**Highly qualified technical personnel** and **Scientific infrastructures**, respectively) are those that bolster other strengths least. Nevertheless, it should be noted that this does not mean that these Strengths can be ignored. Indeed, Strengths and Weaknesses are two sides of the same coin and a strength can turn into a Weakness if it is not looked after properly.

Table AS.2 shows the equivalent analysis of the effect of the institution's Weaknesses in relation to its strengths. As is logical, the weaknesses usually have negative effects on the strengths. Consequently, a very low value of a strength in the «Strategic Value» column indicates that this strength is highly sensitive to the institution's weaknesses. By contrast, a high value indicates that the strength in question is relatively unaffected by the weaknesses of the system. Thus, Strength S2 (**Multidisciplinarity**), which has the highest value (-6), is the least affected by the institution's weaknesses. By contrast, Strength S3 (**Public Image**) is powerfully influenced by the institution's weaknesses (Strategic Value of -22). Following the same line of reasoning, Strengths S1 (**Research workforce**)

TABLE AS.2

EFFECT OF EACH WEAKNESS ON EACH OF THE STRENGTHS

			WEAKNESSES																		
			W1 Financial management	W2 Hiring of staff	W3 Purchasing of infrastructure	W4 Centralised organisation	W5 Dependence on a single Ministry	W6 Lack of independence	W7 Lack of coordination with regional governments	W8 Susceptibility to political vicissitudes	W9 Lack of participation in companies and other institutions	W10 Lack of participation in university postgraduate programmes	W11 Scarcity of own funds for research	W12 High average age of the workforce	W13 Inadequate infrastructure	W14 Insufficient technical and management personnel	W15 Few foreign researchers	W16 Lack of critical mass	W17 Lack of interdisciplinarity	W18 Lack of coordination of outreach activities	W19 Low internal profile of technology transfer	STRATEGIC VALUE
STRENGTHS	S1	Research staff	0	-3	0	0	0	-3	0	-1	-1	0	0	-3	-1	-1	-1	-3	-1	0	-1	-19
	S2	Multidisciplinarity	0	0	0	0	-1	0	0	0	-1	-1	0	0	-1	0	-1	0	-1	0	0	-6
	S3	Public image	0	-2	0	0	-1	-1	-2	-1	-1	-1	-1	-2	-1	-1	-2	-1	-1	-3	-1	-22
	S4	Pool of researchers	0	-3	0	0	-1	-1	-1	0	-1	-3	0	-1	-1	0	-2	-2	0	0	0	-16
	S5	Established nationwide	-2	-1	-1	-3	0	0	-2	0	-1	0	0	0	-2	-1	0	0	0	0	0	-13
	S6	Infrastructures	0	0	-3	-1	-1	-1	-1	-1	0	0	-3	0	-2	0	0	0	0	0	0	-13
	S7	Technical staff	0	-3	0	0	0	-3	0	0	0	0	-2	0	0	-3	0	0	0	0	0	-11
	S8	Technology transfer	0	0	0	-1	0	-1	-1	0	-3	0	-1	-1	-1	-1	0	0	-1	0	-3	-14
	S9	European funds	-1	-2	-2	0	0	0	0	0	0	0	0	-3	0	-1	-3	0	-1	0	-1	-14
	S10	Basic and applied research	0	0	0	0	-1	-1	0	0	-3	0	-2	-1	-2	-2	-1	-1	-2	0	-3	-19
	S11	Industrial and technological interaction	0	0	0	0	-1	0	0	0	-3	0	-1	-1	-1	-1	0	0	-1	0	-3	-12
		SYNERGISTIC IMPACT	-3	-14	-6	-5	-6	-11	-7	-3	-14	-5	-10	-12	-12	-11	-10	-7	-8	-3	-12	

and S10 (**Interaction between basic and applied research**) are Strengths that are very powerfully affected by the institution's weaknesses. Therefore, from the point of view of the effect of weaknesses on the institution's strengths, the most robust strength would be Multidisciplinarity.

As in table AS.1, the Synergistic Impact indicates those Weaknesses that have greatest effect on the Strengths (considered overall). Thus, it can be seen that Weaknesses W2 (**Hiring of staff**) and W9 (**Lack of participation in companies and other institutions**) are the weaknesses that affect most Strengths and to the greatest extent, with a Synergistic Impact of -14. At the opposite end of the scale, W1 (**Economic management**), W8 (**Susceptibility to political vicissitudes**) and W18 (**Lack of coordination of outreach activities**) are the weaknesses with least impact on the CSIC's strengths. The conclusion of this analysis shows that the staff hiring systems and participation of CSIC staff in companies and other institutions need to be improved and bolstered in some way in order to avoid the institution's strengths gradually being eroded. The effect of other weaknesses, to a greater or lesser extent, also requires attention in this «Strengths» section. However, as we shall see, some of the weaknesses with only a slight effect on the institution's strengths can have a powerful negative effect on other elements of the SWOT analysis.

Table AS.3 shows the analysis of the strengths relative to the external threats that may affect the institution. As in the case of the weaknesses, the effect of the threats on the CSIC's strengths is usually negative (or neutral: 0). Among all the strengths, the most resistant and least affected by the threats are S2 (**Multidisciplinarity**) and S7 (**Well qualified technical staff**), with a Strategic Value of -1 and S5 (**Nationwide scope**) with a Strategic Value of -2. By contrast, Strength S8 (**Technology transfer**) is that which is most powerfully affected by external threats, and may lose its overall strategic value if appropriate measures are not taken to protect it from the threats, or at least, offset its effect.

Of all the threats, that which has the most damaging effect on the CSIC's strengths is T1 (Research centres with more advanced management). In effect, the creation of new centres with a new format, a more flexible organisational system better matched to the reality of research, that is to say which are more competitive, is a clear threat to the CSIC, both in terms of competition for resources (funding and staff) and scientific output. The «**Lack of**

TABLE AS.3

EFFECT OF EACH THREAT ON EACH OF THE STRENGTHS

			THREATS								
			T1 Research centres with more advanced management	T2 Exclusion by regions	T3 Exclusion by other ministries	T4 Exclusion by academia	T5 Funding by loans	T6 Other European bodies	T7 Loss of internationalisation	T8 Lack of industrial motivation	STRATEGIC VALUE
STRENGTHS	S1	Research staff	-3	0	0	-1	0	0	-1	0	-5
	S2	Multidisciplinarity	0	0	-1	0	0	0	0	0	-1
	S3	Public image	-2	-1	-1	-2	0	-1	-1	0	-8
	S4	Pool of researchers	-2	-1	-1	-2	0	0	-1	0	-7
	S5	Established nationwide	0	-2	0	0	0	0	0	0	-2
	S6	Infrastructures	-3	-1	-1	0	-3	0	0	0	-8
	S7	Technical staff	-1	0	0	0	0	0	0	0	-1
	S8	Technology transfer	-3	0	-1	0	-1	-2	-1	-3	-11
	S9	European funds	-1	0	0	0	0	-3	-3	0	-7
	S10	Basic and applied research	-1	0	-1	0	-1	-1	0	-3	-7
	S11	Industrial and technological interaction	-2	-1	0	0	0	0	0	-3	-6
		IMPACTO SINERGÍSTICO	-18	-6	-6	-5	-5	-7	-7	-9	

motivation of the industrial sector» (T8) is also a threat to the CSIC's strengths, that is to say, to those related to Knowledge and Technology Transfer.

Table AS.4 summarises the analysis of the Strengths, to the extent that they are bolstered by the Opportunities available in the CSIC's environment. From the point of view of Strategic Value, it may be observed that Strength S3 (**Public Image**) may be bolstered (enhanced) by the Opportunities available to the CSIC. However, S6 (**Scientific Infrastructures**) and S7 (**Well qualified technical staff**), are the strengths that seem to benefit least from the opportunities detected.

As regards the Synergistic Impact, the opportunities that stand out on account of their offering the greatest possibilities to bol-

TABLE AS.4

EFFECT OF EACH OPPORTUNITY ON EACH OF THE STRENGTHS

		OPPORTUNITIES																	
		01 Inter-disciplinary research	02 New scientific niches	03 INGENIO2010	04 New programmes run by the Autonomous Regions	05 Socio-economic demand	06 New spin-off and start-up policies	07 Lisbon conference	08 Observatories	09 Eagerness for popularising programmes	010 Specialist Masters' courses	011 Changes in the national government	012 New scientific personnel programmes	013 Well trained researchers	014 CSIC in international organisations	015 Interface between Latin America and the EU	016 Cooperation with PROs in other countries	017 The CSIC's presence abroad	STRATEGIC VALUE
STRENGTHS	S1 Research staff	3	3	3	3	1	0	1	1	0	1	3	3	3	0	0	1	1	27
	S2 Multidisciplinarity	3	3	3	3	3	0	0	2	2	2	0	0	1	1	1	1	2	27
	S3 Public image	3	3	2	1	3	2	0	2	3	3	2	0	0	3	3	3	3	36
	S4 Pool of researchers	2	3	2	1	1	0	1	0	0	0	2	3	2	0	1	1	1	20
	S5 Established nationwide	1	1	1	2	3	1	0	2	0	1	1	1	2	0	0	0	0	16
	S6 Infrastructures	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	1	8
	S7 Technical staff	1	1	1	1	1	0	0	0	0	0	2	1	1	0	0	0	0	9
	S8 Technology transfer	2	1	3	1	3	3	1	1	0	1	3	1	1	0	1	1	2	25
	S9 European funds	1	2	0	0	0	0	1	0	0	0	0	0	1	3	0	3	3	14
	S10 Basic and applied research	2	1	3	1	3	3	1	2	0	1	0	1	2	0	0	1	1	22
	S11 Industrial and technological interaction	3	1	3	1	3	3	1	3	0	1	2	0	0	1	0	0	1	23
	SYNERGISTIC IMPACT	22	20	22	15	22	12	6	14	5	10	15	10	13	8	6	12	15	

ster the CSIC's strengths, in terms of the number of them or the extent to which they bolster them, are O1 (**Interdisciplinary research**), O3 (**INGENIO2010**) and O5 (**Socio-economic demand for science and technology results**). By contrast, Opportunities O9 (**Outreach programmes**), O7 (**Lisbon conference**) and O15 (**Interface between Latin America and the EU**) are those that seem to have the least Synergistic Impact on the institution's strengths. However, the low values of Synergistic Impact of these Opportunities should not be taken as meaning they are not opportunities worth exploiting. This decision will also depend on how these opportunities interact with the rest of the elements of the SWOT analysis and the cost/benefit ratio of actions directed at them.

Analysis of the Overall Strategic Value of the CSIC's Strengths

The Overall Strategic Value of the CSIC's strengths derives from a joint interaction of each of them with other elements in the SWOT analysis. The integration of the Strategic Values from each table of interactions (Tables AS.1 to AS.4) is given in table AS.5. As the Overall Strategic Value column shows, the Strengths with greatest strategic value would be S2 (**Multidisciplinarity**), S3 (**Public Image**), S11 (**Interaction with the technology-industrial sector**) and S8 (**Technology transfer**). By contrast, according to this analysis, the Strength with the lowest Overall Strategic Value would be S6 (**Scientific infrastructures**). This suggests that if this current strength of CSIC is not defended and nurtured, it could soon turn into a competitive weakness. The ability to capture European Funds (S9) is another strength with a low overall strategic value (weakened strength), to which attention should also be paid.

TABLE AS.5

ANALYSIS OF THE OVERALL STRATEGIC VALUE OF THE STRENGTHS

			STRATEGIC VALUE				
			STRENGTHS	WEAKNESSES	THREATS	OPPORTUNITIES	STRATEGIC VALUE OVERALL
STRENGTHS	S1	Research staff	18	-19	-5	27	21
	S2	Multidisciplinarity	16	-6	-1	27	36
	S3	Public image	22	-22	-8	36	28
	S4	Pool of researchers	20	-16	-7	20	17
	S5	Established nationwide	10	-13	-2	16	11
	S6	Infrastructures	11	-13	-8	8	-2
	S7	Technical staff	13	-11	-1	9	10
	S8	Technology transfer	25	-14	-11	25	25
	S9	European funds	14	-14	-7	14	7
	S10	Basic and applied research	18	-19	-7	22	14
	S11	Industrial and technological interaction	21	-12	-6	23	26

Analysis of the Synergistic Impact of the CSIC's Strengths

In a similar way to the analysis of the Strategic Value of the Strengths discussed in the previous section, table AS.6 gives the analysis of the Overall Synergistic Impact of the CSIC's Strengths taking into account the impact of each of them on the other elements of the SWOT analysis in a combined way. The results are shown on the bottom row of table AS.6. As can be seen, the CSIC's Strength with the greatest (positive) impact on the rest of the elements of the SWOT and which produces the best synergy is S3 (Public image of the CSIC), which has a value of Overall synergistic impact of 94. A strategy that uses this Strength can improve some of the negative elements of the SWOT analysis (Weaknesses and Threats), bolster other strengths, which would be reinforced, and exploit a greater number of Opportunities. Other strengths with a high overall synergistic impact are S1 (**Research workforce**), S2 (**Multidisciplinarity**), S11 (**Interaction with the technological and industrial sector**) and S8 (**Technology transfer**), all of which have values of 70 or more.

By contrast, the Strengths which have least synergy with the rest of the elements of the SWOT analysis appear to be S7 (Well qualified technical staff) and S6 (Scientific infrastructure).

TABLE AS.6

ANALYSIS OF THE SYNERGISTIC IMPACT OF THE STRENGTHS

	SYNERGISTIC IMPACT OF THE STRENGTHS										
	S1 Research staff	S2 Multidisciplinarity	S3 Public image	S4 Pool of researchers	S5 Established nationwide	S6 Infrastructures	S7 Technical staff	S8 Technology transfer	S9 European funds	S10 Basic and applied research	S11 Industrial and technological interaction
STRENGTHS	25	25	16	16	16	10	8	19	13	19	21
WEAKNESSES	18	8	29	10	-3	1	9	18	11	14	21
THREATS	9	10	8	9	10	0	0	7	5	5	7
OPPORTUNITIES	28	35	41	16	19	20	7	26	18	25	22
OVERALL SYNERGISTIC IMPACT	80	78	94	51	42	31	24	70	47	63	71

Final Analysis of the Strengths

The combination of overall Strategic Value and Synergistic Impact for each strength gives an indicator of its utility for the CSIC's strategy in its Action Plan. This combination is referred to here as Strategic Relevance. Table AS.7 shows the values of strategic relevance for each strength, calculated as the sum of its Strategic Value and Synergistic Impact. A higher value indicates greater strategic utility. According to this analysis, the most useful Strengths for the CSIC's strategy would be S3 (**Public image**), S2 (**Multidisciplinarity**), S1 (**Research workforce**), S11 (**Interaction with the technological/industrial sector**) and S8 (**Technology transfer**). By contrast, **Scientific infrastructure** (S6), and **Well qualified technical staff** (S7) are two less important strengths from the strategic point of view, either because other elements in the SWOT analysis have a strong negative effect on them or because they are underutilised by other strengths. This gives them a lower utility, in relative terms. Strengths S10 (**Interaction between basic and applied research**) and S4 (**Pool of researchers**) have high values of Strategic Relevance, suggesting they can be used with confidence. The CSIC's **Nationwide scope** (S5) and its **Ability to capture European funds** (S9) have lower values, alerting to the weakening of these Strengths.

TABLE AS.7

INTEGRATED ANALYSIS OF THE STRATEGIC RELEVANCE OF EACH STRENGTH

			STRATEGIC VALUE	SYNERGISTIC IMPACT	STRATEGIC RELEVANCE
STRENGTHS	S3	Public image	28	94	122
	S2	Multidisciplinarity	36	78	114
	S1	Research staff	21	80	101
	S11	Industrial and technological interaction	26	71	97
	S8	Technology transfer	25	70	95
	S10	Basic and applied research	14	63	77
	S4	Pool of researchers	17	51	68
	S9	European funds	7	47	54
	S5	Established nationwide	11	42	53
	S7	Technical staff	10	24	34
	S6	Infrastructures	-2	31	29

ANALYSIS OF WEAKNESSES

The integrated analysis of the CSIC's weaknesses, as in the case of the other elements of the SWOT analysis, was performed in the same way as described for the Strengths. All the weaknesses confronted

the rest of the SWOT elements, including themselves, and were assigned values for their interaction with each, and then the Strategic Value and Synergistic Impact of each Weakness was calculated with respect to each of the SWOT elements. This analysis is shown in tables AW.1 to AW.4. Tables AW.5 and AW.6 show the Overall Strategic Value and Overall Synergistic Impact of each Weakness deriving from the combination of effects on all the SWOT elements. Finally, table AW.7 shows the values of the Strategic Relevance of each Weakness.

TABLE AW.1

EFFECT OF EACH STRENGTH ON EACH OF THE WEAKNESSES

			STRENGTHS											
			S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	STRATEGIC VALUE
			Research staff	Multidisciplinarity	Public image	Pool of researchers	Established nationwide	Infrastructures	Technical staff	Technology transfer	European funds	Basic and applied research	Industrial and technological interaction	
WEAKNESSES	W1	Financial management	0	0	0	0	-1	0	1	0	-1	0	0	-1
	W2	Hiring of staff	0	0	0	0	-1	0	1	0	0	0	0	0
	W3	Purchasing of infrastructure	0	0	0	0	-1	0	1	0	0	0	0	0
	W4	Centralised organisation	0	0	0	0	-3	0	1	0	0	0	0	-2
	W5	Dependence on a single Ministry	0	0	3	0	1	0	0	1	1	1	1	8
	W6	Lack of independence	0	0	3	0	1	0	0	2	1	1	2	10
	W7	Lack of coordination with regional governments	0	0	3	0	2	0	0	1	1	0	1	8
	W8	Susceptibility to political vicissitudes	0	0	3	0	1	0	0	2	1	0	1	8
	W9	Lack of participation in companies and other institutions	3	2	2	0	1	0	0	3	0	2	3	16
	W10	Lack of participation in university postgraduate programmes	3	3	3	1	3	0	0	0	0	1	0	14
	W11	Scarcity of own funds for research	1	1	2	0	1	0	0	2	1	2	3	13
	W12	High average age of the workforce	2	0	1	3	1	0	0	0	0	0	0	7
	W13	Inadequate infrastructure	-1	-1	1	-1	-1	0	0	1	0	0	2	0
	W14	Insufficient technical and management personnel	-1	-1	1	-1	-1	0	3	1	1	0	1	3
	W15	Few foreign researchers	1	2	2	0	0	1	0	0	3	1	1	11
	W16	Lack of critical mass	3	-3	0	3	-2	0	2	1	1	1	1	7
	W17	Lack of interdisciplinarity	3	3	1	3	1	0	0	1	1	2	2	17
	W18	Lack of coordination of outreach activities	1	1	3	0	-3	0	0	0	0	0	0	2
	W19	Low internal profile of technology transfer	3	1	1	2	-2	0	0	3	1	3	3	15
	SYNERGISTIC IMPACT		18	8	29	10	-3	1	9	18	11	14	21	

According to the analysis shown in table AW.1, the Weaknesses with the least Strategic Value, from the point of view of the utility of the Strengths to offset or mitigate them, are W4 (**Centralised organisation**) and W1 (**Economic management**). None of the CSIC's Strengths seem to be able to avoid the negative effect of these Weaknesses. What is more, given the management demands they entail, Strengths S5 (**Nationwide scope**), and S9 (**Ability to capture European Funds**) highlight these weaknesses more clearly. The interaction between the CSIC's strengths and the weaknesses in **Hiring of staff** (W2), the **Purchase of infrastructure** (W3) and **Inadequate infrastructure** (W13) produce a value of Strategic Value that is insufficient. By contrast, Weakness W17 (**Lack of interdisciplinarity**), W9 (**Low participation in companies and other institutions**) and W19 (**Low internal visibility of technology transfer**) are those with the highest strategic values, indicating that the CSIC's strengths are at least in part able to offset or mitigate them. Also, Strength S3 (**Public image**), has the highest Synergistic Impact for the Weaknesses, indicating its utility in partially compensating for these negative aspects. In the opposite direction, Strength S5 (**Nationwide scope**) shows a value of Synergistic impact of -3, indicating that this strength accentuates rather than mitigates the negative aspect of the Weaknesses. Table AW.2 shows the Weaknesses with the lowest Strategic Value to be W6 (**Lack of independence**), W4 (**Centralised organisation**) and W9 (**Lack of participation in companies and other institutions**). This indicates that these are the weaknesses that are most strongly affected by the institution's other weaknesses. Moreover, the first of these (W6) and W11 (**Lack of own funds for research**) show the lowest values of Synergistic Impact with the other Weaknesses, indicating that these weaknesses aggravate the effects of the others to a greater extent than other weaknesses.

Table AW.3 shows the effect of the Threats on each of the Weaknesses. The most strongly affected is W15 (**Lack of foreign researchers**), although W8 (**Susceptibility to political vicissitudes**) also has a low Strategic Value. The Threats with the highest level of Synergistic Impact on the Weaknesses are T2 (**Loss of central role in regional science policies**) and T3 (**Exclusion from specific scientific environments managed by other ministries**), followed by T5 (**Financing by loans and refundable advances**) and T8 (**Lack of motivation of the industrial sector**). These threats have the greatest negative effect on the Weaknesses. Table AW.4 shows the effect of the Opportunities on the Weaknesses. Of these, those with the least Strategic Value (and

TABLE AW.2

EFFECT OF EACH WEAKNESS ON THE OTHER WEAKNESSES

		WEAKNESSES																			
		W1 Financial management	W2 Hiring of staff	W3 Purchasing of infrastructure	W4 Centralised organisation	W5 Dependence on a single Ministry	W6 Lack of independence	W7 Lack of coordination with regional governments	W8 Susceptibility to political vicissitudes	W9 Lack of participation in companies and other institutions	W10 Lack of participation in university postgraduate programmes	W11 Scarcity of own funds for research	W12 High average age of the workforce	W13 Inadequate infrastructure	W14 Insufficient technical and management personnel	W15 Few foreign researchers	W16 Lack of critical mass	W17 Lack of interdisciplinarity	W18 Lack of coordination of outreach activities	W19 Low internal profile of technology transfer	STRATEGIC VALUE
WEAKNESSES	W1 Financial management	0	0	-1	-2	0	-1	0	0	0	0	-1	0	0	-2	0	0	0	0	0	-7
	W2 Hiring of staff	0	-1	0	-2	0	-3	0	0	2	0	-1	0	0	-2	2	0	0	0	0	-5
	W3 Purchasing of infrastructure	-1	0	0	-2	0	-3	0	0	2	0	-2	0	0	-2	0	0	0	0	0	-8
	W4 Centralised organisation	-2	-2	-2	-2	0	-1	0	0	0	0	0	0	0	-2	0	0	0	0	0	-11
	W5 Dependence on a single Ministry	0	0	0	0	0	0	0	-2	-1	0	-1	0	0	0	0	0	0	0	0	-4
	W6 Lack of independence	-1	-2	-1	-1	-1	0	0	-3	-1	0	-3	0	0	0	0	0	0	0	0	-13
	W7 Lack of coordination with regional governments	0	0	0	-2	0	-2	0	-2	0	0	0	0	0	0	0	0	0	-1	0	-7
	W8 Susceptibility to political vicissitudes	0	0	0	0	-2	-3	0	0	0	0	-3	0	0	0	0	0	0	0	0	-8
	W9 Lack of participation in companies and other institutions	-1	-2	-1	-1	0	-3	0	0	0	0	-1	0	0	0	0	0	0	0	-1	-10
	W10 Lack of participation in university postgraduate programmes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	W11 Scarcity of own funds for research	0	0	-1	0	0	-2	-1	-3	0	0	0	0	0	0	0	0	0	0	0	-7
	W12 High average age of the workforce	0	-2	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	-4
	W13 Inadequate infrastructure	0	0	0	0	0	-1	-2	-2	-1	0	-3	0	0	0	0	0	0	0	0	-9
	W14 Insufficient technical and management personnel	-1	-2	0	0	0	-1	0	0	0	0	-3	0	0	0	0	0	0	0	0	-7
	W15 Few foreign researchers	0	-2	0	0	0	0	0	0	0	0	-2	0	0	0	-1	-1	-1	0	0	-7
	W16 Lack of critical mass	0	-2	0	0	0	0	0	0	0	0	-1	-1	0	-1	0	0	-1	0	0	-6
	W17 Lack of interdisciplinarity	0	0	0	0	0	0	0	0	0	0	-1	-1	0	0	0	-1	-1	0	0	-4
	W18 Lack of coordination of outreach activities	0	0	0	-3	0	0	-3	0	0	0	-1	0	0	-2	0	0	0	0	0	-9
	W19 Low internal profile of technology transfer	0	0	0	0	0	0	0	0	-1	0	0	-1	0	0	0	0	0	0	-1	-3
	IMPACTO SINERGÍSTICO	-6	-15	-6	-15	-3	-22	-6	-12	0	0	-23	-3	0	-11	1	-2	-3	-1	-2	

which are therefore most negatively affected by the Opportunities) are W1 and W2 (**Economic management** and **Hiring of staff**, respectively), while at the opposite end, Weakness W17 (**Lack of interdisciplinarity**), is that which is most alleviated by the opportunities, with a relatively high positive Strategic Value (+20).

TABLE AW.3

EFFECT OF EACH THREAT ON EACH OF THE WEAKNESSES

			THREATS								
			T1 Research centres with more advanced management	T2 Exclusion from regions	T3 Exclusion by other ministries	T4 Exclusion by academia	T5 Funding by loans	T6 Other European bodies	T7 Loss of internationalisation	T8 Lack of industrial motivation	STRATEGIC VALUE
WEAKNESSES	W1	Financial management	0	0	0	0	-3	0	0	0	-3
	W2	Hiring of staff	0	0	0	0	0	0	0	0	0
	W3	Purchasing of infrastructure	0	0	0	0	-3	0	0	0	-3
	W4	Centralised organisation	0	0	0	0	0	0	0	0	0
	W5	Dependence on a single Ministry	0	-1	-3	0	0	0	0	-1	-5
	W6	Lack of independence	0	0	-1	0	-3	0	0	-1	-5
	W7	Lack of coordination with regional governments	0	-3	0	0	0	0	0	0	-3
	W8	Susceptibility to political vicissitudes	0	-2	-3	0	0	0	-1	-1	-7
	W9	Lack of participation in companies and other institutions	0	-1	-2	0	0	0	-1	-2	-6
	W10	Lack of participation in university postgraduate programmes	0	0	0	-3	0	0	0	0	-3
	W11	Scarcity of own funds for research	0	-1	-1	0	-1	0	0	-1	-4
	W12	High average age of the workforce	-1	0	0	0	0	-1	-1	0	-3
	W13	Inadequate infrastructure	-1	-1	-1	0	-1	0	0	-1	-5
	W14	Insufficient technical and management personnel	-1	0	0	0	0	0	0	0	-1
	W15	Few foreign researchers	-2	0	0	0	0	-3	-3	0	-8
	W16	Lack of critical mass	-2	0	0	0	0	0	0	0	-2
	W17	Lack of interdisciplinarity	0	0	0	0	0	0	-1	-1	-2
	W18	Lack of coordination of outreach activities	0	-3	-1	-1	0	0	-1	0	-6
	W19	Low internal profile of technology transfer	0	0	0	0	0	0	0	-3	-3
		SYNERGISTIC IMPACT	-7	-12	-12	-4	-11	-4	-8	-11	

Of all the Opportunities, the one showing the most accentuated Synergistic Impact on the Weaknesses is O11 (**Changes in national government**). In effect, the possibility of transforming the CSIC into a national agency is a good opportunity to correct or at least mitigate some of the institution's weaknesses.

TABLE AW.4

EFFECT OF EACH OPPORTUNITY ON EACH OF THE WEAKNESSES

		OPPORTUNITIES																	
		01 Inter-disciplinary research	02 New scientific niches	03 INGENIO 2010	04 New programmes run by the Autonomous Regions	05 Socio-economic demand	06 New spin-off and start-up policies	07 Lisbon conference	08 Observatories	09 Eagerness for popularising programmes	010 Specialist Masters' courses	011 Changes in the national government	012 New scientific personnel programmes	013 Well trained researchers	014 CSIC in international organisations	015 Interface between Latin America and the EU	016 Cooperation with PROs in other countries	017 The CSIC's presence abroad	STRATEGIC VALUE
WEAKNESSES	W1 Financial management	0	0	-1	-1	0	-1	0	0	0	0	2	0	0	0	0	-1	-3	-5
	W2 Hiring of staff	0	0	-1	-1	0	0	0	0	0	0	2	-1	-1	0	-1	-2	-3	-8
	W3 Purchasing of infrastructure	0	0	-1	-1	0	0	0	0	0	0	2	0	0	0	0	-1	-3	-4
	W4 Centralised organisation	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	-1	-3	-2
	W5 Dependence on a single Ministry	0	0	1	1	1	1	0	1	0	1	2	1	0	0	0	0	0	9
	W6 Lack of independence	0	0	1	1	1	1	0	0	0	0	2	0	0	0	0	0	0	6
	W7 Lack of coordination with regional governments	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	4
	W8 Susceptibility to political vicissitudes	0	0	0	1	1	1	0	1	0	0	2	0	0	0	0	0	0	6
	W9 Lack of participation in companies and other institutions	0	0	1	1	1	2	1	1	1	1	2	0	0	0	1	3	3	18
	W10 Lack of participation in university postgraduate programmes	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	3
	W11 Scarcity of own funds for research	0	0	1	1	1	0	0	0	0	0	3	0	0	0	0	0	0	6
	W12 High average age of the workforce	1	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	5
	W13 Inadequate infrastructure	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	1	1	6
	W14 Insufficient technical and management personnel	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	4
	W15 Few foreign researchers	1	1	0	0	0	0	1	0	0	0	0	2	0	1	3	3	3	15
	W16 Lack of critical mass	1	1	1	1	1	0	1	0	0	0	1	1	1	0	0	1	1	11
	W17 Lack of interdisciplinarity	3	2	2	1	2	0	1	1	0	0	1	1	1	1	1	1	2	20
	W18 Lack of coordination of outreach activities	0	0	0	1	0	0	0	1	3	1	0	0	0	0	0	0	0	6
	W19 Low internal profile of technology transfer	0	0	1	1	1	1	1	0	0	1	0	0	0	1	0	0	0	7
	SYNERGISTIC IMPACT	6	4	8	9	12	5	5	6	5	5	25	5	3	3	4	4	-2	

Analysis of the Overall Strategic Value of the CSIC's Weaknesses

From the integrated analysis of the particular Strategic Values of the Weaknesses with each of the SWOT elements (Table AW.5) the most negative weaknesses for the institution can be deduced to be W1-W4, all of which are related to the institution's internal management. This is due almost exclusively to the restrictions imposed by national government management rules, which the CSIC, as a public body, is obliged to abide by. By contrast, Weakness W17 (**Lack of interdisciplinarity**) is that which shows the greatest strategic value, indicating that with the right strategy it could easily be rectified thanks to the positive effect that the set of SWOT elements as a whole have on it.

TABLE AW.5

ANALYSIS OF THE OVERALL STRATEGIC VALUE OF THE WEAKNESSES

			STRATEGIC VALUE				
			STRENGTHS	WEAKNESSES	THREATS	OPPORTUNITIES	STRATEGIC VALUE OVERALL
WEAKNESSES	W1	Financial management	-1	-7	-3	-5	-16
	W2	Hiring of staff	0	-5	0	-8	-13
	W3	Purchasing of infrastructure	0	-8	-3	-4	-15
	W4	Centralised organisation	-2	-11	0	-2	-15
	W5	Dependence on a single Ministry	8	-4	-5	9	8
	W6	Lack of independence	10	-13	-5	6	-2
	W7	Lack of coordination with regional governments	8	-7	-3	4	2
	W8	Susceptibility to political vicissitudes	8	-8	-7	6	-1
	W9	Lack of participation in companies and other institutions	16	-10	-6	18	18
	W10	Lack of participation in university postgraduate programmes	14	0	-3	3	14
	W11	Scarcity of own funds for research	13	-7	-4	6	8
	W12	High average age of the workforce	7	-4	-3	5	5
	W13	Inadequate infrastructure	0	-9	-5	6	-8
	W14	Insufficient technical and management personnel	3	-7	-1	4	-1
	W15	Few foreign researchers	11	-7	-8	15	11
	W16	Lack of critical mass	7	-6	-2	11	10
	W17	Lack of interdisciplinarity	17	-4	-2	20	31
	W18	Lack of coordination of outreach activities	2	-9	-6	6	-7
	W19	Low internal profile of technology transfer	15	-3	-3	7	16

Analysis of the Synergistic Impact of the CSIC's Weaknesses

The analysis of the Overall Synergistic Impact (Table AW.6) shows that the weaknesses that have the greatest negative effect on the rest of the SWOT elements are W2 (**Hiring of staff**) and W11 (**Lack of own funds for research**). W6 (**Lack of independence**) and W13 (**Insufficient infrastructure**) also have a powerful negative impact.

TABLE AW.6

ANALYSIS OF THE SYNERGISTIC IMPACT OF THE WEAKNESSES

	SYNERGISTIC IMPACT OF THE WEAKNESSES																	
	D1 Financial management	D2 Hiring of staff	D3 Purchasing of infrastructure	D4 Centralised organisation	D5 Dependence on a single Ministry	D6 Lack of independence	D7 Lack of coordination with regional governments	D8 Susceptibility to political vicissitudes	D9 Lack of participation in companies and other institutions	D10 Lack of participation in university postgraduate programmes	D11 Scarcity of own funds for research	D12 High average age of the workforce	D13 Inadequate infrastructure	D14 Insufficient technical and management personnel	D15 Few foreign researchers	D16 Lack of critical mass	D17 Lack of interdisciplinarity	D18 Lack of coordination of outreach activities	D19 Low internal profile of technology transfer
STRENGTHS	-3	-14	-6	-5	-6	-11	-7	-3	-14	-5	-10	-12	-12	-11	-10	-7	-8	-3	-12
WEAKNESSES	-6	-15	-6	-15	-3	-22	-6	-12	0	0	-23	-3	0	-11	1	-2	-3	-1	-2
THREATS	-5	-9	-7	-2	-4	-6	-4	-4	-4	-3	-7	-4	-7	-3	-8	0	0	-2	-3
OPPORTUNITIES	-14	-25	-10	-6	-3	-8	-5	-3	-10	-5	-23	-4	-22	-12	-10	-2	-13	-5	-11
OVERALL SYNERGISTIC IMPACT	-28	-63	-29	-28	-16	-47	-22	-22	-28	-13	-63	-23	-41	-37	-27	-11	-24	-11	-28

Final Analysis of the Weaknesses

Table AW.7 shows the integrated analysis of the CSIC's weaknesses according to the SWOT analysis. As can be seen, weaknesses W2 and W11 (**Hiring of staff** and **Lack of own funds for research**, respectively) are those which have the most strongly negative Strategic Relevance. This implies that these Weaknesses must be dealt with in some way in the CSIC's strategy for the coming years as they could have a decisive impact on the institution's activity. By contrast, Weaknesses W10 and W17 (**Lack**

of participation in university postgraduate programmes and **Lack of interdisciplinarity**, respectively) are those that show more optimistic values of Strategic Relevance, indicating that, bearing in mind the Strengths and Opportunities of the institution, these Weaknesses can be corrected without too much difficulty.

TABLE AW.7

INTEGRATED ANALYSIS OF THE STRATEGIC RELEVANCE OF EACH WEAKNESS

			STRATEGIC VALUE	SYNERGISTIC IMPACT	STRATEGIC RELEVANCE
WEAKNESSES	W2	Hiring of staff	-13	-63	-76
	W11	Scarcity of own funds for research	8	-63	-55
	W13	Inadequate infrastructure	-8	-41	-49
	W6	Lack of independence	-2	-47	-49
	W1	Financial management	-16	-28	-44
	W3	Purchasing of infrastructure	-15	-29	-44
	W4	Centralised organisation	-15	-28	-43
	W14	Insufficient technical and management personnel	-1	-37	-38
	W8	Susceptibility to political vicissitudes	-1	-22	-23
	W7	Lack of coordination with regional governments	2	-22	-20
	W18	Lack of coordination of outreach activities	-7	-11	-18
	W12	High average age of the workforce	5	-23	-18
	W15	Few foreign researchers	11	-27	-16
	W19	Low internal profile of technology transfer	16	-28	-12
	W9	Lack of participation in companies and other institutions	18	-28	-10
	W5	Dependence on a single Ministry	8	-16	-8
	W16	Lack of critical mass	10	-11	-1
	W10	Lack of participation in university postgraduate programmes	14	-13	1
	W17	Lack of interdisciplinarity	31	-24	7

ANALYSIS OF THREATS

The integrated analysis of the Threats is shown in tables AT.1 to AT.7. Table AT.1 shows that Threat T1 (**Research centres with more advanced management**) is that with the highest strategic value for the Institution's strengths. In fact, almost all the CSIC's identified strengths have the potential to mitigate the threat implied by other research centres which, as a result of their mode of operation, can offer researchers apparently more advantageous conditions. These research centres, in general, are smaller than the CSIC and are usually focused on specific topics. Their specific

management systems make them more competitive at performing research activity than the CSIC. This is largely due to the fact that they are not subject to the same degree of regulations, which are much more restrictive at the central government level where the CSIC is situated. However, the institution's Strengths are extremely valuable in terms of protecting it against the competitive threat these centres represent. Features such as **Multidisciplinarity** (S2), **Nationwide scope** (S5) and the extensive **pool of researchers** it is able to draw upon (S4) are characteristic of the CSIC and not generally shared by more monothematic centres located at a single site.

Additionally, Threat T5 (**Loan finance**) seems to be the threat against which the CSIC's strengths are able to do least, and which could have important repercussions for the institution's activity if measures are not taken to protect against it.

From the point of view of the Synergistic Impact, the CSIC's most useful strengths against the Threats it faces are S2 (**Multidisciplinarity**), S5 (**Nationwide scope**), perhaps due

TABLE AT.1

EFFECT OF EACH STRENGTH ON EACH OF THE THREATS

			STRENGTHS											
			S1 Research staff	S2 Multidisciplinarity	S3 Public image	S4 Pool of researchers	S5 Established nationwide	S6 Infrastructures	S7 Technical staff	S8 Technology transfer	S9 European funds	S10 Basic and applied research	S11 Industrial and technological interaction	STRATEGIC VALUE
THREATS	T1	Research centres with more advanced management	2	3	1	3	3	0	0	1	1	1	1	16
	T2	Exclusion from regions	1	1	1	1	2	0	0	1	1	1	1	10
	T3	Exclusion by other ministries	1	2	1	1	2	0	0	1	0	1	1	10
	T4	Exclusion by academia	1	1	1	1	1	0	0	0	0	0	0	5
	T5	Funding by loans	0	0	0	0	0	0	0	1	1	0	1	3
	T6	Other European bodies	1	1	1	1	0	0	0	0	0	0	0	4
	T7	Loss of internationalisation	3	1	1	2	0	0	0	0	2	0	0	9
	T8	Lack of industrial motivation	0	1	2	0	2	0	0	3	0	2	3	13
	SYNERGISTIC IMPACT		9	10	8	9	10	0	0	7	5	5	7	

to the fact that these best characterise the CSIC's activity. By contrast, S6 (**Scientific infrastructure**) and S7 (**Well qualified technical personnel**), in the current situation, are not of great utility in protecting the CSIC from its threats. This alerts us to the somewhat precarious state of these strengths, which are about to turn into weaknesses if steps are not taken to bolster them.

TABLE AT.2

EFFECT OF EACH WEAKNESS ON EACH OF THE THREATS

			WEAKNESSES																			
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	STRATEGIC VALUE
			Financial management	Hiring of staff	Purchasing of infrastructure	Centralised organisation	Dependence on a single Ministry	Lack of independence	Lack of coordination with regional governments	Susceptibility to political vicissitudes	Lack of participation in companies and other institutions	Lack of participation in university postgraduate programmes	Scarcity of own funds for research	High average age of the workforce	Inadequate infrastructure	Insufficient technical and management personnel	Few foreign researchers	Lack of critical mass	Lack of interdisciplinarity	Lack of coordination of outreach activities	Low internal profile of technology transfer	
THREATS	T1	Research centres with more advanced management	-1	-3	-2	-1	-1	-3	-1	-1	-1	0	-3	-2	-2	-2	-2	0	0	0	0	-25
	T2	Exclusion from regions	0	0	0	-1	0	0	-3	-1	-1	0	0	0	0	0	0	0	0	-1	0	-7
	T3	Exclusion by other ministries	0	0	0	0	-3	0	0	-2	-1	0	0	0	-1	0	0	0	0	0	0	-7
	T4	Exclusion by academia	0	0	0	0	0	0	0	0	0	-3	0	0	0	0	0	0	0	-1	0	-4
	T5	Funding by loans	-3	0	-3	0	0	-3	0	0	0	0	-1	0	-2	0	0	0	0	0	0	-12
	T6	Other European bodies	-1	-3	-2	0	0	0	0	0	0	0	-2	-1	-2	-1	-3	0	0	0	0	-15
	T7	Loss of internationalisation	0	-3	0	0	0	0	0	0	0	0	-1	-1	0	0	-3	0	0	0	0	-8
	T8	Lack of industrial motivation	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	-3	-4
	SYNERGISTIC IMPACT		-5	-9	-7	-2	-4	-6	-4	-4	-4	-3	-7	-4	-7	-3	-8	0	0	-2	-3	

The analysis of the Strategic Value of the Threats vis-à-vis the Weaknesses of the institution reveals that Threat T1 (**Research centres with more advance management**) is again that with the most significant Strategic Value, although on this occasion in a negative sense, unlike its situation regarding the Strengths. Indeed, although the CSIC's strengths are of more use to it against

this threat, its weaknesses, on the other hand, make it more susceptible.

As regards the Synergistic Impact of the Weaknesses vis-à-vis the Threats, the values of most of them are fairly uniform. W2 (**Hiring staff**) and W15 (**Lack of foreign researchers**) showed the greatest impact. By contrast, W16 (**Lack of critical mass**) and W17 (**Lack of interdisciplinarity**) are less critical vis-à-vis the Threats.

The analysis of interactions between the Threats shown in table AT.3 suggests that T1 (**Research centres with more advanced management**) have the strongest Strategic Value and Synergistic Impact. In other words, this threat is worsened by the other threats, and in turn, has a greater effect on them. This identifies it as being the most serious of the Threats in the CSIC's current context.

TABLE AT.3

EFFECT OF EACH THREAT ON THE OTHER THREATS

			THREATS								
			T1	T2	T3	T4	T5	T6	T7	T8	
			Research centres with more advanced management	Exclusion from regions	Exclusion by other ministries	Exclusion by academia	Funding by loans	Other European bodies	Loss of internationalisation	Lack of industrial motivation	STRATEGIC VALUE
THREATS	T1	Research centres with more advanced management	0	-1	-2	0	-1	0	-1	0	-5
	T2	Exclusion from regions	-1	0	0	0	0	0	0	0	-1
	T3	Exclusion by other ministries	-2	0	0	0	0	0	0	0	-2
	T4	Exclusion by academia	-1	0	0	0	0	0	0	0	-1
	T5	Funding by loans	-2	0	0	0	0	0	0	0	-2
	T6	Other European bodies	0	0	0	0	0	0	-1	0	-1
	T7	Loss of internationalisation	-1	0	0	0	0	-1	-1	0	-3
	T8	Lack of industrial motivation	0	0	0	0	0	0	0	-3	-3
		SYNERGISTIC IMPACT	-7	-1	-2	0	-1	-1	-3	-3	

The assessment of the Threats vis-à-vis the Opportunities offered by the environment once again highlights Threat T1 (**Research centres with more advanced management**) and its greater Strategic Value, together with T7 (**Loss of internationalisation**). Nevertheless, unlike the situation of the Weaknesses and Threats commented upon in the preceding paragraphs, the Strategic Values of these Threats with respect to the Opportunities are positive, indicating that the Opportunities available to the CSIC can help it overcome these Threats better. However, Threat T5 (**Loan financing**) is that which is least mitigated by the CSIC's opportunities, which highlights the importance of increasing the CSIC's ability to take on debt in order to be able to use this form of funding.

Opportunities O1 and O17 (**Interdisciplinary research** and the **CSIC's presence abroad**, respectively) are those which show the greatest Synergistic Impact on the Threats. This is consonant with the CSIC's two strengths, S2 and S5 (Multidisciplinarity and

TABLE AT.4

EFFECT OF EACH OPPORTUNITY ON EACH OF THE THREATS

			OPPORTUNITIES																	
			O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	O13	O14	O15	O16	O17	STRATEGIC VALUE
			Inter-disciplinary research	New scientific niches	INGENIO2010	New programmes run by the Autonomous Regions	Socio-economic demand	New spin-off and start-up policies	Lisbon conference	Observatories	Eagerness for popularising programmes	Specialist Masters' courses	Changes in the national government	New scientific personnel programmes	Well trained researchers	CSIC in international organisations	Interface between Latin America and the EU	Cooperation with PROs in other countries	The CSIC's presence abroad	
THREATS	T1	Research centres with more advanced management	3	2	1	-1	0	0	0	1	1	1	1	1	0	1	1	2	3	17
	T2	Exclusion from regions	1	1	0	1	1	0	0	1	1	1	0	0	0	0	0	0	0	7
	T3	Exclusion by other ministries	1	1	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0	7
	T4	Exclusion by academia	1	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	5
	T5	Funding by loans	0	0	-1	0	1	0	0	0	0	0	3	0	0	0	0	0	0	3
	T6	Other European bodies	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	3	9
	T7	Loss of internationalisation	1	1	0	0	0	0	1	0	0	0	2	2	0	1	2	3	3	16
	T8	Lack of industrial motivation	1	1	2	0	2	3	2	1	0	1	1	0	0	0	0	0	0	14
		SYNERGISTIC IMPACT	9	7	3	0	5	3	3	5	4	5	7	3	1	3	4	7	9	

Nationwide scope, respectively). Indeed, multidisciplinarity is the situation prior to interdisciplinarity, while opening the CSIC up to the world by setting up centres abroad is no more than an extension of its current nationwide presence. Opportunities O4 and O13 (New regional programmes and Well trained researchers) are those with least Synergistic Impact on the Threats, thus revealing their limited value in protecting the institution against these threats.

Analysis of the Overall Strategic Value of the Threats

The overall analysis of the Strategic Values of the Threats indicates that T5, and to a lesser extent, T6 (**Loan financing** and **Other European bodies**, respectively) are those that obtain a lower net result, indicating that they are the most dangerous for the CSIC as an institution. The first of them could have an impact on its activity, as it affects financial aspects of the organisation. The second has an impact on the international aspects of the CSIC's activity, as an institution that aims to play a central and leadership role in research, as this only makes sense in a globalised context on a world scale.

TABE AT.5

ANALYSIS OF THE OVERALL STRATEGIC VALUE OF THE THREATS

			STRENGTHS	WEAKNESSES	THREATS	OPPORTUNITIES	OVERALL STRATEGIC VALUE
THREATS	T1	Research centres with more advanced management	16	-25	-5	17	3
	T2	Exclusion from regions	10	-7	-1	7	9
	T3	Exclusion by other ministries	10	-7	-2	7	8
	T4	Exclusion by academia	5	-4	-1	5	5
	T5	Funding by loans	3	-12	-2	3	-8
	T6	Other European bodies	4	-15	-1	9	-3
	T7	Loss of internationalisation	9	-8	-3	16	14
	T8	Lack of industrial motivation	13	-4	-3	14	20

Analysis of the Synergistic Impact of the Threats

From the point of view of the effect on other elements of the SWOT, the threat which has the greatest Synergistic impact is T1 (**Research centres with more advanced management**). This threat considerably weakens the institution's strengths and reduces its potential

to exploit its opportunities. Threats T8 and T7 (**Lack of motivation in the industrial sector** and **Loss of internationalisation**) also show a marked negative impact. Nevertheless, given their relatively high strategic value, they do not seem to constitute an insoluble threat to the institution.

TABLE AT.6

ANALYSIS OF THE SYNERGISTIC IMPACT OF THE THREATS

	SYNERGISTIC IMPACT OF THE THREATS							
	T1	T2	T3	T4	T5	T6	T7	T8
	Research centres with more advanced management	Exclusion from regions	Exclusion by other ministries	Exclusion by academia	Funding by loans	Other European bodies	Loss of internationalisation	Lack of industrial motivation
STRENGTHS	-18	-6	-6	-5	-5	-7	-7	-9
WEAKNESSES	-7	-12	-12	-4	-11	-4	-8	-11
THREATS	-7	-1	-2	0	-1	-1	-3	-3
OPPORTUNITIES	-14	-3	-5	-6	-8	-5	-14	-15
OVERALL SYNERGISTIC IMPACT	-46	-22	-25	-15	-25	-17	-32	-38

Final Analysis of the Threats

The combined analysis of the Strategic Values and Synergistic Impact of the various threats the CSIC faces reveals that Threat T1 (**Research centres with more advanced management**) is the most serious threat for the institution, followed by T5 (**Loan financing**). This result focuses the worst threats for the CSIC in the national sphere. This confers a high level of risk upon them, given that an institution that is threatened at the national level can hardly compete at the international level. Faced with these threats it is necessary to design and implement initiatives allowing these negative effects to be mitigated.

The second block of threats which could have the greatest effect on the institution are related to the international aspects of the CSIC's activity. Threat T6 (**Other European organisations**) has an impact on the international sphere in which the CSIC competes with other research institutions and centres, both for resources and for the production and exploitation of research findings. Threat T7 (**Loss of internationalisation**) is directly related to the previous threat and alerts to the danger that the institution is relegated to an excessively domestic sphere of action.

The threats relating to institutional aspects that are national in nature, although with a clear negative effect on the CSIC's activity, appear less severe, either because they are simpler to rectify or because of their more limited final impact on the functioning of the institution.

TABLE AT.7

INTEGRATED ANALYSIS OF THE STRATEGIC RELEVANCE OF EACH THREAT

			STRATEGIC VALUE	SYNERGISTIC IMPACT	STRATEGIC RELEVANCE
THREATS	T1	Research centres with more advanced management	3	-46	-43
	T5	Funding by loans	-8	-25	-33
	T6	Other European bodies	-3	-17	-20
	T7	Loss of internationalisation	14	-32	-18
	T8	Lack of industrial motivation	20	-38	-18
	T3	Exclusion by other ministries	8	-25	-17
	T2	Exclusion from regions	9	-22	-13
	T4	Exclusion by academia	5	-15	-10

ANALYSIS OF OPPORTUNITIES

This last section of the integrated analysis of the SWOT elements describes the results of the analysis of the opportunities available to the CSIC. Following the same structure of analysis as in the previous sections, the Opportunities were analysed vis-à-vis all the elements of the SWOT analysis, including themselves.

Table AO.1 shows the matrix of interactions between the Strengths and Opportunities. As can be observed, Opportunity O5 (**Socio-economic demand for scientific and technological results**) is that which shows the highest Strategic Value with respect to the use of the CSIC's strengths.

Other Opportunities, such as O3 (**INGENIO2010 programme**), O1 (**Interdisciplinary research**), O2 (**New scientific niches**), O13 (**Well trained researchers**), O4 (**New regional programmes**), and O8 (**«Observatories» of socio-political interest**) also show high Strategic Values, considering the institution's strengths. By contrast, Opportunity O11 (**Changes in national government**) has a low strategic value from the point of view of the CSIC's strengths. This makes sense as, while the CSIC's strengths may be enhanced by this opportunity, its ability to influence it is very limited.

TABLE AO.1

EFFECT OF EACH STRENGTH ON EACH OF THE OPPORTUNITIES

			STRENGTHS											
			S1 Research staff	S2 Multidisciplinarity	S3 Public image	S4 Pool of researchers	S5 Established nationwide	S6 Infrastructures	S7 Technical staff	S8 Technology transfer	S9 European funds	S10 Basic and applied research	S11 Industrial and technological interaction	STRATEGIC VALUE
OPPORTUNITIES	O1	Inter-disciplinary research	3	3	1	2	0	3	1	3	3	2	2	23
	O2	New scientific niches	3	3	1	2	0	3	1	3	3	2	1	22
	O3	INGENIO2010	3	3	3	1	1	3	1	3	0	3	3	24
	O4	New programmes run by the Autonomous Regions	3	3	3	1	3	3	1	1	0	1	1	20
	O5	Socio-economic demand	3	3	3	1	3	3	1	3	1	3	3	27
	O6	New spin-off and start-up policies	1	1	1	0	1	1	0	3	0	3	3	14
	O7	Lisbon conference	1	1	1	0	1	1	1	1	1	1	1	10
	O8	Observatories	2	3	3	0	2	2	0	1	1	3	3	20
	O9	Popular science programmes	1	3	3	0	2	0	0	0	0	1	1	11
	O10	Specialist Masters' courses	1	3	3	0	2	0	0	3	0	3	2	17
	O11	Changes in the national government	0	0	1	0	0	0	0	1	0	0	1	3
	O12	New scientific personnel programmes	1	1	3	3	2	0	0	0	1	1	0	12
	O13	Well trained researchers	2	3	3	3	2	1	1	0	3	2	1	21
	O14	CSIC in international organisations	1	2	3	0	0	0	0	1	2	0	0	9
	O15	Interface between Latin America and the EU	1	1	3	3	0	0	0	1	1	0	0	10
	O16	Cooperation with PROs in other countries	1	1	3	0	0	0	0	1	1	0	0	7
	O17	The CSIC's presence abroad	1	1	3	0	0	0	0	1	1	0	0	7
	SYNERGISTIC IMPACT		28	35	41	16	19	20	7	26	18	25	22	

As regards the Synergistic Impact of the Strengths on the Opportunities, that which stands out is S3 (**Public image**), and secondly, S2 (**Multidisciplinarity**). Both strengths have a considerable impact on a wide range of opportunities. By contrast, Strength S7 (**Technical personnel**) is that which shows the least impact.

The analysis of the Opportunities versus the Weaknesses shows that Opportunity O17 (The CSIC's **presence abroad**) is that which has the most negative Strategic Value in relation to the weaknesses. This is not surprising given the management overload that opening and running CSIC centres in other countries would suppose, and which would at present be seriously affected by the weaknesses of the institution in these aspects. Although to a lesser extent, Opportunities O1 (**Interdisciplinary research**), O5 (**Socio-economic demand for scientific and technological results**), O16 (**Cooperation with PROs in other countries**), O2 (**New scientific niches**) and O6 (**New policies for spin-offs and start-ups**) are also seriously affected by the institution's weaknesses and, therefore, show highly negative strategic values. By contrast, Opportunities O14 (**The CSIC in international organisations**) and O8 (**Observatories of socio-political interest**) appear to be least affected by the CSIC's weaknesses.

Hiring of staff (W2), the **Shortage of own funds for research** (W11), and **Inadequate infrastructure** (W13) are the weaknesses with the most strongly negative impact on the opportunities, and therefore, those which have a greater influence on the CSIC's success in exploiting them. By contrast, the **Lack of critical mass** (W16), **Dependence on a single ministry** (W5), and **Susceptibility to political vicissitudes** (W8), are those with the least negative influence on the Opportunities.

In relation to the threats, the most seriously affected opportunities are O3 and O16 (**INGENIO2010 programme** and **Cooperation with PROs in other countries**), with a strategic value of -7 and O4 (New regional programmes) with a value of -6. The least affected is O11 (**Changes in national government**) with a strategic value of 0 in relation to the threats. Of these, those with a stronger Synergistic Impact are T8 (**Lack of motivation in the industrial sector**), T1 (**Research centres with more advanced management**), and T7 (**Loss of internationalisation**). The effect of these Threats on the Opportunities is negative, although their effects are not as intense as the Opportunities and the set

TABLE AO.2

EFFECT OF EACH WEAKNESS ON EACH OF THE OPPORTUNITIES

			WEAKNESSES																			
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	STRATEGIC VALUE
			Financial management	Hiring of staff	Purchasing of infrastructure	Centralised organisation	Dependence on a single Ministry	Lack of independence	Lack of coordination with regional governments	Susceptibility to political vicissitudes	Lack of participation in companies and other institutions	Baja participación en postgrado universitario	Escasez de fondos propios para investigación	Alta edad media de la plantilla	Infraestructuras insuficientes	Personal técnico y de gestión insuficiente	Pocos investigadores extranjeros	Falta de masa crítica	Baja interdisciplinariedad	Poca coordinación en divulgación	Baja visibilidad interna de Transferencia de Tecnología	
SYNERGISTIC IMPACT	01	Inter-disciplinary research	0	-1	-1	0	-1	0	0	0	-1	-1	-3	-1	-3	-1	-1	-1	-3	0	-1	-19
	02	New scientific niches	0	-1	-1	0	-1	0	0	0	0	-1	-3	-1	-3	-1	-1	-1	-2	0	-1	-17
	03	INGENIO2010	-1	-2	-1	0	0	0	0	-2	-1	0	0	0	-3	-2	0	0	-1	0	-1	-14
	04	New programmes run by the Autonomous Regions	-1	-2	-1	-1	0	0	-3	0	0	0	0	0	-3	-1	0	0	-1	0	0	-13
	05	Socio-economic demand	-2	-3	-1	-1	0	-1	0	0	-1	0	-3	0	-3	-1	0	0	-1	0	-2	-19
	06	New spin-off and start-up policies	-3	-1	-1	0	0	-1	0	0	-3	0	-3	-1	-1	0	0	0	0	0	-3	-17
	07	Lisbon conference	0	-1	0	0	0	0	0	0	0	0	-1	0	0	-1	0	0	0	0	-1	-4
	08	Observatories	0	0	0	0	0	0	0	1	0	0	0	0	-1	0	0	0	-1	-1	-1	-3
	09	Popular science programmes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-3	0	-4
	010	Specialist Masters' courses	0	0	0	0	0	0	0	0	0	-3	0	0	0	0	0	0	-1	-1	-1	-6
	011	Changes in the national government	-1	-2	-1	0	-1	-1	0	-2	0	0	0	0	0	0	0	0	0	0	0	-8
	012	New scientific personnel programmes	0	-3	0	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	0	-5
	013	Well trained researchers	0	-3	0	0	0	0	-2	0	0	0	-1	0	-1	0	0	0	-1	0	0	-8
	014	CSIC in international organisations	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-1	0	0	0	0	-2
	015	Interface between Latin America and the EU	-1	-1	0	0	0	0	0	0	0	0	-3	0	-1	-1	-1	0	0	0	0	-8
	016	Cooperation with PROs in other countries	-2	-2	0	-1	0	-2	0	0	-3	0	-3	0	-1	-1	-2	0	-1	0	0	-18
	017	The CSIC's presence abroad	-3	-3	-3	-3	0	-3	0	0	-1	0	-3	-1	-1	-2	-3	0	0	0	0	-26
		IMPACTO SINERGÍSTICO	-14	-25	-10	-6	-3	-8	-5	-3	-10	-5	-23	-4	-22	-12	-10	-2	-13	-5	-11	

of opportunities on which each of the threats acts is different. The threat which has the most powerful effect on the Opportunities is T2 (**Exclusion from the regions: loss of centrality in regional scientific policies**) with a synergistic effect of -3, manifested solely in the institution's ability to exploit Opportunity O4 (**New regional programmes**).

TABLE AO.3

EFFECT OF EACH THREAT ON EACH OF THE OPPORTUNITIES

			THREATS								
			T1	T2	T3	T4	T5	T6	T7	T8	STRATEGIC VALUE
			Research centres with more advanced management	Exclusion from regions	Exclusion by other ministries	Exclusion by academia	Funding by loans	Other European bodies	Loss of internationalisation	Lack of industrial motivation	
OPPORTUNITIES	01	Inter-disciplinary research	0	0	-1	0	-1	0	-1	-1	-4
	02	New scientific niches	-1	0	-1	0	-1	0	-1	-1	-5
	03	INGENIO2010	-2	0	0	0	-3	0	0	-2	-7
	04	New programmes run by the Autonomous Regions	-1	-3	0	0	-2	0	0	0	-6
	05	Socio-economic demand	-1	0	0	0	0	0	0	-3	-4
	06	New spin-off and start-up policies	-2	0	0	0	0	0	0	-3	-5
	07	Lisbon conference	0	0	0	0	-1	0	0	-3	-4
	08	Observatories	-1	0	-1	-1	0	0	-1	0	-4
	09	Popular science programmes	0	0	0	-1	0	0	0	0	-1
	010	Specialist Masters' courses	0	0	0	-3	0	0	0	-2	-5
	011	Changes in the national government	0	0	0	0	0	0	0	0	0
	012	New scientific personnel programmes	-2	0	-1	0	0	0	-1	0	-4
	013	Well trained researchers	-2	0	-1	0	0	-1	-1	0	-5
	014	CSIC in international organisations	0	0	0	0	0	-1	-2	0	-3
	015	Interface between Latin America and the EU	0	0	0	-1	0	0	-1	0	-2
	016	Cooperation with PROs in other countries	-2	0	0	0	0	-2	-3	0	-7
	017	The CSIC's presence abroad	0	0	0	0	0	-1	-3	0	-4
		SYNERGISTIC IMPACT	-14	-3	-5	-6	-8	-5	-14	-15	

The interaction of some opportunities with others is most favourable in the case of Opportunities O1 (Interdisciplinary research) and O2 (New scientific niches) with Strategic Values 34 and 31, respectively. These opportunities are bolstered by practically all the others. The least affected are O9 (Popularisation programmes) and O11 (Changes in national government).

TABLE AO.4

EFFECT OF EACH OPPORTUNITY ON THE OTHER OPPORTUNITIES

			OPPORTUNITIES																	
			01	02	03	04	05	06	07	08	09	010	011	012	013	014	015	016	017	STRATEGIC VALUE
			Inter-disciplinary research	New scientific niches	INGENIO2010	New programmes run by the Autonomous Regions	Socio-economic demand	New spin-off and start-up policies	Lisbon conference	Observatories	Popular science programmes	Specialist Masters' courses	Changes in the national government	New scientific personnel programmes	Well trained researchers	CSIC in international organisations	Interface between Latin America and the EU	Cooperation with PROs in other countries	The CSIC's presence abroad	
OPPORTUNITIES	01	Inter-disciplinary research	3	3	3	3	3	1	1	3	1	2	0	3	3	1	1	2	1	34
	02	New scientific niches	3	1	2	3	3	1	1	3	1	2	0	3	3	1	1	2	1	31
	03	INGENIO2010	3	3	0	0	3	3	3	1	0	0	3	3	3	0	0	0	0	25
	04	New programmes run by the Autonomous Regions	3	3	0	0	3	0	0	1	0	0	1	1	3	0	0	0	0	15
	05	Socio-economic demand	3	3	1	1	3	3	2	2	1	3	2	1	3	0	1	0	0	29
	06	New spin-off and start-up policies	3	3	1	0	3	0	2	1	0	1	2	0	1	0	1	0	0	18
	07	Lisbon conference	1	1	3	0	1	1	0	1	0	0	1	1	1	0	0	0	0	11
	08	Observatories	3	2	1	0	2	0	1	1	0	1	0	0	1	2	1	2	2	19
	09	Popular science programmes	3	1	0	0	1	0	0	1	1	2	0	0	0	0	0	0	0	9
	010	Specialist Masters' courses	3	1	0	0	3	1	0	1	1	1	0	0	0	0	0	0	0	11
	011	Changes in the national government	0	0	3	0	1	1	2	0	0	0	1	1	0	0	0	0	0	9
	012	New scientific personnel programmes	1	1	1	2	0	0	2	0	0	0	1	1	3	1	1	1	2	17
	013	Well trained researchers	3	3	1	3	1	0	2	0	0	1	0	3	1	0	0	1	1	20
	014	CSIC in international organisations	3	3	0	0	0	0	1	1	0	0	1	0	0	2	2	3	3	19
	015	Interface between Latin America and the EU	1	1	0	0	1	1	0	1	0	1	1	1	0	1	2	2	2	15
	016	Cooperation with PROs in other countries	2	2	0	0	1	1	1	1	0	1	1	1	1	3	2	3	3	23
	017	The CSIC's presence abroad	2	2	0	0	1	1	1	1	0	0	1	0	0	3	3	3	3	21
		SYNERGISTIC IMPACT	40	33	16	12	30	14	19	19	5	15	15	19	23	14	15	19	18	

Popular science programmes (O9) is also the opportunity with the least Synergistic Impact on the others. This is reasonable bearing in mind the concrete environment in which scientific outreach and popularisation has its influence. Nevertheless, this opportunity may be of considerable use in other aspects of the institution, such as its public image. Moreover, this activity ties in directly with one of the CSIC's missions: promoting scientific culture in society. The Opportunities showing a greater Synergistic Impact on the others are O1 (**Interdisciplinary research**), O2 (**New scientific niches**) and O5 (**Socio-economic demand for scientific and technological results**).

Analysis of the Overall Strategic Value of the Opportunities

The combined effect of all the elements of the SWOT analysis on the opportunities confers a greater Strategic Value to Opportunities O1 (**Interdisciplinary research**), O5 (**Socio-economic demand for scientific and technological results**), O8 (**Observatories of socio-political interest**) and O2 (**New scientific niches**). By contrast, the CSIC's presence abroad (O17) shows least Strategic Value (-2), indicating that the institution's strengths are currently insufficient to offset the negative effects of its weaknesses, despite the fact that many of its opportunities support actions in this direction. Opportunities O11 (**Changes in national government**) and O16 (**Cooperation with foreign PROs**) also seem to draw no benefit from the effect of these elements of the SWOT analysis and show an almost neutral Strategic Value.

TABLE AO.5

ANALYSIS OF THE OVERALL STRATEGIC VALUE OF THE OPPORTUNITIES

			STRENGTHS	WEAKNESSES	THREATS	OPPORTUNITIES	OVERALL STRATEGIC VALUE
OPPORTUNITIES	01	Inter-disciplinary research	23	-19	-4	34	34
	02	New scientific niches	22	-17	-5	31	31
	03	INGENIO2010	24	-14	-7	25	28
	04	New programmes run by the Autonomous Regions	20	-13	-6	15	16
	05	Socio-economic demand	27	-19	-4	29	33
	06	New spin-off and start-up policies	14	-17	-5	18	10
	07	Lisbon conference	10	-4	-4	11	13
	08	Observatories	20	-3	-4	19	32
	09	Popular science programmes	11	-4	-1	9	15
	010	Specialist Masters' courses	17	-6	-5	11	17
	011	Changes in the national government	3	-8	0	9	4
	012	New scientific personnel programmes	12	-5	-4	17	20
	013	Well trained researchers	21	-8	-5	20	28
	014	CSIC in international organisations	9	-2	-3	19	23
	015	Interface between Latin America and the EU	10	-8	-2	15	15
	016	Cooperation with PROs in other countries	7	-18	-7	23	5
	017	The CSIC's presence abroad	7	-26	-4	21	-2

Analysis of the Synergistic Impact of the CSIC's Opportunities

The analysis of the impact of each of the Opportunities on the other elements of the SWOT analysis shown in table AO.6 highlights that Opportunity O1 (**Interdisciplinary research**) has the greatest combined synergistic impact, followed by O5 (**Socio-economic demand for scientific and technological results**), O2 (**New scientific niches**) and O11 (**Changes in national government**). From among these opportunities, those which have the most balanced Synergistic Impacts (similar values in the elements of the SWOT analysis) are O11 and O6, whereas O1 and O2 have poor values compared with the institution's Weaknesses, indicating that these Opportunities are of limited use in improving the CSIC's weaknesses.

The eagerness of the educational sector for quality popular science programmes (O9) shows a lesser Synergistic Impact in this analysis, with reduced incidence in most elements of the SWOT analysis, probably due to its reduced scope for action.

TABLE AO.6

ANALYSIS OF THE SYNERGISTIC IMPACT OF THE OPPORTUNITIES

	SYNERGISTIC IMPACT OF THE OPPORTUNITIES																
	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	O13	O14	O15	O16	O17
	Inter-disciplinary research	New scientific niches	INGENIO2010	New programmes run by the Autonomous Regions	Socio-economic demand	New spin-off and start-up policies	Lisbon conference	Observatories	Popular science programmes	Specialist Masters' courses	Changes in the national government	New scientific personnel programmes	Well trained researchers	CSIC in international organisations	Interface between Latin America and the EU	Cooperation with PROs in other countries	The CSIC's presence abroad
STRENGTHS	22	20	22	15	22	12	6	14	5	10	15	10	13	8	6	12	15
WEAKNESSES	6	4	8	9	12	5	5	6	5	5	25	5	3	3	4	4	-2
THREATS	9	7	3	0	5	3	3	5	4	5	7	3	1	3	4	7	9
OPPORTUNITIES	40	33	16	12	30	14	19	19	5	15	15	19	23	14	15	19	18
OVERALL SYNERGISTIC IMPACT	77	64	49	36	69	34	33	44	19	35	62	37	40	28	29	42	40

Final Analysis of the Opportunities

The combined analysis of the Strategic Values and Synergistic Impacts of the Opportunities (Table AO.7) indicates that the best opportunities from the strategic point of view are O1 (Interdisciplinary research), O5 (Socio-economic demand for scientific and technological results), and O2 (New scientific niches). These opportunities show high values of Strategic Value and Synergistic Impact. A second block includes Opportunities O3 (INGENIO2010 programme), O8 (Observatories of socio-political interest), O13 (Well trained researchers) and O11 (Changes in the national government). The latter has a high Synergistic Impact, but its low Strategic Value reduces its final Strategic Relevance. The bottom of the table shows the opportunities with the least Strategic Relevance: O17 (Presence of the CSIC abroad) and O9 (Popular science programmes). In the first of these two cases, the difficulties inherent in actions of this type represent a significant challenge for the institution's strengths and weaknesses. For this reason, any measure in this direction needs to be undertaken with caution and restraint. In the second case (Popular science programmes) their significance is marginal due to the limited impact they have on the institution's activity as a whole. However, the economic cost and effort actions in this area might entail make them reasonably feasible with the CSIC's current strengths and weaknesses. In other words, the cost/benefit ratio could be favourable.

TABLE AO.7

INTEGRATED ANALYSIS OF THE STRATEGIC RELEVANCE OF EACH OPPORTUNITY

			STRATEGIC VALUE	SYNERGISTIC IMPACT	STRATEGIC RELEVANCE
OPPORTUNITIES	01	Inter-disciplinary research	34	77	111
	05	Socio-economic demand	33	69	102
	02	New scientific niches	31	64	95
	03	INGENIO2010	28	49	77
	08	Observatories	32	44	76
	013	Well trained researchers	28	40	68
	011	Changes in the national government	4	62	66
	012	New scientific personnel programmes	20	37	57
	010	Specialist Masters' courses	17	35	52
	04	New programmes run by the Autonomous Regions	16	36	52
	014	CSIC in international organisations	23	28	51
	016	Cooperation with PROs in other countries	5	42	47
	07	Lisbon conference	13	33	46
	015	Interface between Latin America and the EU	15	29	44
	06	New spin-off and start-up policies	10	34	44
	017	The CSIC's presence abroad	-2	40	38
	09	Popular science programmes	15	19	34

5 DEFINITION OF THE CSIC'S STRATEGY

The integrated SWOT analysis described in Chapter 4 gives a basis for reflection on which to build the strategy of the CSIC as an institution over the coming years. On the basis of this analysis it is possible to distinguish the best aspects of the institution (those with greatest strategic relevance) in each of the sections, and it will be on these that the most pro-active and forward looking strategy will be built. The analysis also identifies those more critical aspects of the CSIC that could be improved and for which strategic actions need to be designed so as to re-activate them or correct their shortcomings so as to avoid, or at least mitigate, the deleterious effect they currently have on the institution's activities. This package of strategic measures must identify as its goal avoiding these weaknesses of the CSIC from worsening yet further.

The CSIC's strategy for the next four years has as its general objectives those defined in the institution's mission statement:

- To promote and perform **top quality scientific research.**
- To encourage **knowledge transfer** to the productive sector.
- To **train researchers** to a high standard.
- To promote and transmit **scientific culture** to society.
- To be present at an **international level**.

On the basis of these objectives and the outcome of the SWOT analysis, various Strategic Lines have been defined, which include actions designed to fulfil the objectives of each line. In some cases these actions are shared by several strategic lines.

The strategic lines into which the CSIC's activity will be channelled over the period this Action Plan is in effect are described below.

FRONTERA STRATEGIC LINE

The actions envisaged in this strategic line aim to promote and encourage top quality scientific research at the CSIC. These actions centre on providing direct support to frontier research by research groups or supporting centres and institutions with specific funding for scientific research and equipment. The first of these aspects arises out of the high strategic relevance given to **interdisciplinary research** in the SWOT analysis. In the second case, this strategic line promotes the autonomy and co-responsibility of the CSIC's centres and institutes in achieving the institution's mission. This aims to equip the centres with human and financial resources they need

The CSIC's structure is highly multidisciplinary. This multidisciplinarity has allowed new lines of interdisciplinary research to emerge in the frontiers between different areas of knowledge. New concepts and development appear in these hybrid zones where disciplines merge and have the potential to drive new scientific knowledge and progress.

in order to organise their research strategy in advance. These actions aim to rectify weaknesses W4 (**Centralised organisation**) and W13 (**Inadequate infrastructure**) and to facilitate and bolster top quality research at the CSIC's centres and institutions. The actions designed in this line depend on the resources the CSIC as an institution is able to acquire, and these depend mainly on higher bodies (Ministry of Education and Science, Ministry of the Economy and Treasury, Public Administrations Ministry, etc.) beyond the scope of the institution's control and competence. The actions envisaged in *FRONTERA* are:

1. ***INTERSECTA* action:** This action aims to promote interdisciplinary research bringing together CSIC research groups through the In-house Frontier Research Projects (***Proyectos Intramurales de Frontera***). Following the same lines begun two years ago, the in-house frontier research projects programme will continue to be maintained and strengthened. Our intention is to run a call for proposals for projects which involve interactions between various scientific areas and are of an exceptionally innovative nature. Unlike previous editions, we intend to open up participation in these projects to researchers from other institutions in Spain and abroad, so they can offer their ideas and know-how to CSIC groups, which will necessarily lead the execution of projects of this type.
2. ***EQUIPA* action:** this action will mean that centres and institutes will be able to draw upon the economic resources assigned to them to purchase scientific infrastructure earlier. With the approval of this plan of action, CSIC centres and institutes will receive a pre-allocation of funding for each of the years the plan is in effect (See table 0.2, page 22). In this way, centres/institutes will be able to plan their investments in equipment in the light of the funds available from the central organisation, to which they will be able to add subsidies obtained from external sources or produced by their own activity.
3. ***INCENTIVA* action:** this action will provide centres/institutes with subsidies for use in research (equipment, staff, costs of running projects, etc. The allocation of these funds to productivity bonuses is expressly prohibited). The amount each centre/institute receives will depend on the resources generated by the centre/institute from external sources, the assessment given of the quality of the research work they do, and the institution's available budget each year. This action aims to

create incentives for institutes to acquire research funding and to raise the level of their scientific output, in both quantitative and qualitative terms. A procedure will be established whereby once the activity of each centre/institute has been evaluated, it will be assigned a coefficient of proportionality (*INCENTIVA* coefficient) which will determine the percentage of funding it has managed to obtain in each year, and which it will receive as ***Incentiva* Funding.** The final value of this funding will be determined by the total amount available to this action from the institution.

FRONTERA will also use other actions mainly designed for other strategic lines, such as *TRANSFER*, in which the *INTECNIA* projects action is included. This action aims to boost research in projects at the phase prior to their transfer to the productive sector. This objective frequently coincides with an interdisciplinary approach to problems. Other actions within other strategic lines from which *FRONTERA* may be able to benefit include the offer of public employment, Scientific staff and the Post-doctoral JAE[10] programme within the *INCORPORA* strategy line, and the Pre-doctoral JAE programme and JAE technicians programme in *EXPERTIA*. Through these actions each institute will be assigned a number of tenured scientist posts, JAE post-doctoral and technician contracts and pre-doctoral grants for each year the Action Plan is in effect (see table 0.1, page 20).

TRANSFER STRATEGIC LINE

One of the CSIC's characteristics as a research institution is the autonomy its researchers enjoy to explore different topics without conditions being place upon them by the institution other than the ability to obtain funding with which to conduct their research. This has had clear advantages for the national scientific system. However, society is increasingly calling for solutions to problems into which research is not being carried out with sufficient vigour. Although some of society's needs and concerns on research topics are addressed through the National R&D Plan (*Plan Nacional de I+D*) there is a lot of inertia in the system and at times it is unable to respond with to socio-economic demands with sufficient speed.

[10] The JAE (*Junta de Ampliación de Estudios*)programmes have started with this CSIC action plan for 2006-2009 and are intended to replace, albeit with different characteristics, the I3P (*Itinerario Integrado de Inserción Profesional*) programmes.

TRANSFER focuses on the exploitation of research results by means of direct knowledge transfer actions. This strategic line draws upon several of the CSIC's best strengths in terms of strategic relevance. These include its **Public Image** (S3), which gives undoubted credibility in the eyes of the public to the research undertaken by the institution and means that it is well regarded by industry and the productive sector as a whole; its **Multidisciplinarity** (S2), which allows the CSIC to offer solutions in a wide variety of fields and areas of development; its **Research staff** (S1), which is wide ranging and competitive; the good **Interactions with the technological and industrial sectors** (S11); its **Technology transfer** (S8) capability; and the **Interaction between basic and applied research** (S10). Moreover, *TRANSFER* would allow the opportunities that present themselves in the CSIC's context which have a high strategic relevance to be exploited, such as the **Socio-economic demand for research results** (O5), the **INGENIO2010 Programme** (O3), and **Interdisciplinary research** (O1), although the latter does not have a direct impact on the results of progress that will undoubtedly be produced by this type of research. Moreover, the actions envisaged in *TRANSFER* could go some way towards mitigating the CSIC's weaknesses, such as the **Scarcity of own funds for research** (W11), given that in the medium to long term these transfer actions will represent new sources of funding, **independent from political vicissitudes** (W8). Thus, it may be envisaged that the *TRANSFER* actions might alleviate the weaknesses due to **Inadequate infrastructure** (W3), **Lack of participation in companies and other institutions** (W9) and, as a result of the direct *TRANSFER* actions, the **Low internal visibility of Technology Transfer** (W19). In effect, although the CSIC's research staff is good and reasonably competitive, it perhaps lacks sufficient incentives for knowledge transfer in terms of professional recognition or merit. One of the actions discussed below aims to tackle this weakness and give greater status to this kind of activity among scientists. The aim is to promote the practical application of the results of research undertaken by researchers with basic guidance, so as to raise their awareness of knowledge transfer to the productive sector and open up new possibilities for the exploitation of research results.

Lastly, *TRANSFER* will also make it possible to soften one of the possible threats facing the CSIC: the **Lack of motivation of the industrial sector** (A8), if it manages to convince this sector, by the

weight of evidence, of the institution's ability to solve the development and progress problems facing businesses.

The actions envisaged in *TRANSFER* are:

1. **A company: *CSIC-K2B (CSIC-Knowledge to Business)*:** the CSIC's Action Plan for 2006-2009 envisages the creation, as a matter of urgency, of a public company with 100% of its capital provided by the CSIC. The company's purpose will be to promote the transfer of knowledge produced by the CSIC's researchers to the productive sectors and other sectors of society. Its creation aims to:
   - Bring the CSIC's knowledge and technology to private companies in a rapid, flexible and transparent way.
   - Facilitate ownership of stakes in private companies, in particular new technology-based firms and technology service units that may be created using its knowledge.
   - To acquire and incentivise highly qualified technical personnel.

   In short, the aim of CSIC-K2B is to create an organisational structure that is closer to the business culture, which looks for new and improved forms of public-private collaboration in the innovation field in order to bring the competitive advantage to the Spanish productive sector that the current age demands.
2. **CSIC-Business Economic Interest Groups:** the basic aim pursued through the creation of these entities is to give a better focus to the CSIC's research towards solving society's needs and generating wealth and well-being. It will therefore have a sectoral focus, with a strong multidisciplinary component, and in principle, covering the whole spectrum of R&D. These economic interest groups are intended to make a very significant contribution to transferring the knowledge generated to the productive and other sectors. In 2003 one structure of this type was set up in the form of an economic interest group (AIE in its Spanish initials) with the company *Carburos Metálicos*. It was given the name **MATGAS 2000**, and was located on the Bellaterra campus in Barcelona. For the period 2006-2009 we initially envisage the creation of several of these AIEs focused on the following topics:
   - Stock rearing resources
   - Information technology

The CSIC's Action Plan for 2006-2009 envisages the creation of a public company with 100% of its capital provided by the CSIC. The company's purpose will be to promote the transfer of knowledge produced by the CSIC's researchers to the productive sectors and other sectors of society.

- Alternative energy sources. Biofuels and Fuel cells
- Water and Environmental Technologies

3. ***TRANSCIENDE* Action:** This action aims to incorporate the **knowledge transfer** function into the processes of defining the CSIC's strategies and those of the bodies that oversee their correct implementation. This will make it possible to better exploit the opportunities that arise as a result of the increased CSIC budgets and the budgets devoted to transfer by other public and private bodies. It will improve the competitive capabilities of the CSIC vis-à-vis other public and private R&D centres and will allow improved corporate planning to tackle and overcome the issue of Spanish industry's low absorptive capacity for innovation.

   Moreover, this action will promote the recognition of knowledge transfer activities in the selection process and foster the visibility of these activities among the CSIC's research staff. To do so, the staff of the Technology Transfer Office will make visits to the CSIC's centres and institutes to disseminate its activity and support mechanisms to researchers with an entrepreneurial spirit who wish to exploit the results of their research commercially. What is more, these visits will also have the aim of arousing the interest of those researchers who are least motivated and furthest from transfer initiatives. The final goal of this action is to raise the status of knowledge transfer within the institution's scientific community, although its vocation is to extend this recognition to the whole of the national scientific community. Finally, actions analysing the scientific, technological and human capacities of those groups with a high profile in areas of special interest to the organisation will be undertaken, in order to make it easier to organise and classify these capacities. The overall aim is to stimulate the various options for knowledge transfer in them and to increase the efficiency of future transfer actions.

4. ***PREGENERA* Action**: The purpose of this action is to promote the creation of technology-based firms and technology service units by opening up a line of finance specifically intended for use in the stages leading to their incorporation as companies. The *PREGENERA* action will allow entrepreneurial researchers at the CSIC to carry out the steps needed to create technology-based firms or technology service units, such as conducting technological, legal, industrial and market feasibility studies, receive advice from experts, train their teams, set up their premises in

science and technology parks (including those promoted by the CSIC), etc. This aims to increase the number of CSIC researchers devoted to promoting technology-based firms, as it will allow them to start developing their business with a much more controlled level of risk, and to leverage other public and private sources of funding from outside the institution under more favourable terms.

5. ***INVERTIA* Action:** With this action the Institution aims, through CSIC-K2B, to own a stake in start-up and spin-off companies and technology service units. The creation of technology-based firms and technology service units is one of the instruments available to the CSIC by which it can transfer its knowledge to the productive sector and a route for the generation of quality employment for highly qualified personnel trained by the CSIC. This approach is particularly appropriate when the need exists to transfer a significant amount of tacit knowledge or when the «receptive capacity» of the market, particularly locally, is low. This low level of receptiveness may be due to the research result's being insufficiently developed, and a technology-based firm is the ideal environment in which to mature it into a commercial product. The CSIC will put in place a mechanism allowing it to take a stake in and give its support to technology-based firms that have arisen out of initiatives by its researchers. The CSIC's direct participation in these companies will be an advantageous formula for the institution, enabling it to profit from its research efforts.

6. ***JAE-Transfer* programme**: a JAE programme will be set up to train staff as «prospectors». Their role will be to look for opportunities to transfer the CSIC's research. These personnel will be valuable for OTRIs, venture capital firms and funds focusing on high-tech firms, as envisaged and encouraged in the INGENIO2010 programme. To train these personnel, we envisage organising a Master's degree in Knowledge Transfer, possibly in cooperation with other institutions. This programme will be set in the framework of the interface between the CSIC and the company CSIC-K2B.

7. ***INTECNIA* Projects:** With these projects we aim to increase the rate of technology transfer to the productive sector. INTECNIA projects are aimed at basic research work which needs additional research to assess its suitability for transfer to the productive sector. In these projects the actual participa-

Research Networks and Observatories will be instruments to be encouraged during the period 2006-2009 in order to address wide ranging trans-disciplinary thematic research of scientific and social interest.

tion of companies in their financing will be looked upon as an additional merit.

OBSERVA STRATEGIC LINE

This strategic line aims to exploit opportunities O8 («**Observatories**» **of social and political interest**), O1 (**Interdisciplinary research**), and O2 (**New scientific niches**). For this purpose we will utilise the CSIC strengths S3 (**Public Image**), S2 (**Multidisciplinarity**), S1 (**Research workforce**), and S5 (**Nationwide scope**). The fundamental aim of this strategic line is to set up research networks on trans-disciplinary themes of scientific and social interest. To do so it will use two closely related tools, which in some cases actually constitute two facets of the same concept. These tools are **Research networks** and **Observatories.** The latter will, in many cases, be linked to a research network, raising its profile and communicating the activities of the research network to the social, political and economic environment. This strategic line is therefore articulated into the following actions:

1. ***REDES* Action:** This action will promote the creation of research networks on specific topics requiring a multidisciplinary approach and/or benefiting from active participation in and coordination with various research groups. REDES will define topics on which research networks need to be created, taking those that already exist as its starting point. *REDES* will set up a procedure for the creation and management of each network, and assign it a level of funding. This might include the hiring of management personnel to bear the administrative overload of the network coordinator. Also, the network will have an annual budget for the execution of specific research projects, which it needs to distribute between the groups taking part in the network according to their participation. The networks created under this action will be functionally dependent on the area committee to which they belong. In the case of trans-disciplinary networks covering various science and technology areas, they will depend on the areas involved acting in a coordinated way.

2. ***OBSERVATORIOS* Action:** the Observatories are instruments of scientific/technological surveillance which carry out Foresight functions such as alerting and advising the scientific community, society in general, and economic and political sectors of the situation of the thematic areas they have been set up to monitor. In

many cases these Observatories will be the visible part of research networks created under the REDES Action. The funding assigned to these Observatories will basically be for their management and for running projects associated with them. Moreover, in the framework of this action, we also envisage the possibility of funding meetings and symposia restricted to groups participating in the Observatory. Both the REDES action and OBSERVATORIOS may include research groups and researchers from other institutions, as well as those of the CSIC. *OBSERVA* will benefit from the *GRUPOS* and *AGRUPA* actions in the *INCORPORA* strategic line.

A new Researcher career will be defined which will encompass and build on the current one. Mechanisms will also be put into place to define and structure the research groups currently operating in the CSIC.

INCORPORA STRATEGIC LINE

This strategic line is focused on bolstering the institution's research staff. Through *INCORPORA* we aim to recruit new researchers on to the CSIC's workforce, by exploiting opportunity O13 (**Well trained researchers**). The actions envisaged in this line not only involve offering more opportunities to new staff (permanent or otherwise), but they also include changes in the institution's current research staff structure. These changes are currently deemed to be necessary, and indeed imperative, in order for the CSIC to be able to situate itself at the level of other international research institutions.

This strategy line also envisages an analysis of the CSIC's research groups. The research group is the basic operational unit of research activity. However, despite the CSIC's long and solid history in research, there is at present no directory identifying its research groups. The actions envisaged in this area will enable the structure of the institution's research groups to be established and determined. This information is necessary for the rational and optimal design of research actions and activities.

The actions envisaged in *INCORPORA* are:

1. **New Researcher Career:** a new researcher career will be defined, encompassing and expanding on the current one. This new scheme will involve the creation of two new scales: **Associate Scientist** and **Distinguished Research Professor. Associate scientists** represent a stage prior to that of tenured scientist and so will be equivalent to the idea of a «tenure track». This phase will last 5 years and be subject to evaluations in the 3rd and 4th year. If these evaluations are passed, the candidate will progress to tenured scientist grade in the fifth year. **Distinguished re-**

search professor will be a special scale to allow exceptional researchers to join the CSIC on advantageous terms above the level of research professors. Both scales will be on a contract rather than public servant basis.

2. **Public Offer of Employment. Scientific Personnel:** this is one of the main strands of the CSIC's Action Plan for 2006-2009. The aim is to increase the offer of positions, particularly on the tenured scientist scale, which is that currently set for entry to the institution. The forecast annual allocation of posts for new tenured scientists at the centres and institutes has been drawn up based on the strategic plans in each case.

3. ***JAE-Postdoctoral* programme**: This new programme replaces the previous *I3P-Postdoctoral* programme. It aims to complement similar programmes from external sources. The current hiring scheme will be maintained. As in the case of positions for new tenured scientists, provisions to *JAE-Postdoctoral* contracts have been pre-assigned to each centre/institute with an annual forecast for the period in which the action plan is in effect, as described in the strategic plans of the centres/institutes.

4. **Generic *INCORPORA* action:** this generic action envisages all the actions by which researchers at levels of beyond postdoctoral training coming from public announcements of positions join the CSIC (Ramón y Cajal, Juan de la Cierva, or Ministry of Education and Science programmes, or programmes at the autonomous region level such as Averroes, Parga Pondal, ICREA, etc.). Measures will be put in place (to be defined) to facilitate the development of the activity of these researchers on a pre-selective basis prior to their joining the new researcher career at the CSIC.

5. **In-house induction projects:** newly recruited research staff will be supported by in-house induction projects. These projects, which will have a maximum duration of two years, aim to enable newly recruited research personnel to start (or resume) their research work.

6. ***GRUPOS* Action:** Within this action we envisage carrying out an in-depth analysis of the situation of the CSIC as regards the research groups currently operating, de facto, at its centres and institutes. This analysis will take into account the various different group parameters (funding, themes, methodological dependencies, etc.) and the pre-established interrelations. The conclusion

of this analysis and the objective of this action is the preparation of a document describing the specific minimum requirements that are essential for establishing the definition of the CSIC's research group. *GRUPOS* will be executed as a directed research project.

7. ***AGRUPA* Action:** This action will be the continuation of *GRUPOS* and its objective will be to establish the catalogue of research groups working in the CSIC according to the criteria laid down by *GRUPOS*. The overall aim is to situate all the CSIC's research personnel within a group schema.

8. ***EQUIPARA* Action:** This action is focused on achieving equality of opportunities in terms of access to the CSIC for various disadvantaged social groups and the disabled.

9. **Gender Equity Horizontal Action:** This action is aimed at achieving real equality of opportunities in terms of access to the CSIC and to eliminate gender-related differences in the selection or professional promotion processes. This action has been included on the initiative of the Women and Science Committee, which was set up in 2002 to monitor sex-based differences in the various processes and procedures developed or carried out at the CSIC and to promote equality between men and women in the institution. This committee has prepared a proposal for a Gender Equity Horizontal Action in the CSIC, which is included, together with the Strategic Plans of the Horizontal Units, in volume II of this Action Plan for the period 2006-2009. This proposed Horizontal Action includes a series of specific actions based on European community policies, to implement in the CSIC, in order to guarantee real equality between men and women in the institution. Among others, these translate into the disaggregation of statistics and data relating to the CSIC, disaggregated by sex; aiming for parity between the sexes in the posts to which the governing bodies and commissions are free to make appointments, guaranteeing equity in selection processes, making it essential for the institutes to present an annual report to the Presidency on the measures adopted to fulfil this action, etc. The CSIC aspires to be the first PRO to achieve the European Union's objective for 2010, to which Spain is a signatory, which translates into the target of 25% of the upper rung of the professional ladder being occupied by women (women currently account for 17% of the research professors category).

SUSTENTA STRATEGIC LINE

The actions envisaged in the *SUSTENTA* strategic line are oriented towards increasing the CSIC's numbers of research and management support personnel. As mentioned in the Strengths section of the SWOT analysis, having **Well qualified technical personnel** (S7) is one of the CSIC's strengths. However, at the same time the scarcity of these personnel is also one of its weaknesses (W14: **Insufficient technical and management personnel**). *SUSTENTA* aims to correct this weakness and reinforce this strength. The actions envisaged are of two types. On the one side the line aims to promote the training of qualified technical personnel and on the other, to increase their numbers.

At the same time, some of the CSIC's most serious weaknesses are associated with its management: W2 (**Hiring of staff**), W1 (**Economic management**), W3 (**Purchase of infrastructure**), W4 (**Centralised organisation**), W14 (**Insufficient technical and management personnel**). These are largely due to the management restrictions to which the institution is subject, as it is obliged to follow procedures and formats that are ill suited to modern research institutions. However, some of these weaknesses could be mitigated if the institution had sufficient numbers of adequately trained management personnel. Indeed, some of the management problems that the institution faces day to day are due to the excessive centralisation of certain formalities. This, in turn, is due to the shortage of management personnel at the centres and institutes and the heterogeneity of their training and qualifications. With *SUSTENTA* we aim to take measures to alleviate these weaknesses somewhat and allow a more dynamic, less centralised and more flexible style of management to develop, in so far as the current legislation and legal status of the institution permits. In short, the aim is to take the CSIC's management to the limit of its possibilities. At all events, it should be noted that these weaknesses and associated problems only highlight the unsuitability of the current legal structure of the CSIC for the research activity it performs. This calls for it to be changed urgently into a state agency, something we anticipate may happen during the lifetime of this Action Plan. Within SUSTENTA various actions leading to an increase in management personnel numbers are envisaged, not only at centres and institutes, but also within the central organisation, which is currently overloaded to breaking point. Actions whose aim is to improve and enhance management personnel's level of training and

automate procedures so they can be made more agile are also envisaged.

The following actions are envisaged in *SUSTENTA*:

1. **New Technician Career:** in a similar way to the researcher career, a Technician Career will be created in the CSIC, envisaging various scales and accompanied by the creation of modern systems of promotion and incentivisation for personnel on this career path. The final structure will be set within the framework of the transformation of the CSIC into a state agency.
2. **OEP-Technician Action**: the offer of public employee posts for technical personnel focusing on common services and research groups, linking personnel posts with support to research groups as defined in the *AGRUPA* action under the *INCORPORA* strategic line.
3. **OEP-Management Action**: In the period 2006-2009 management posts will be offered as a matter of urgency, in numbers and of levels sufficient to allow the rapid and effective management demanded by research in the global scenario that characterises scientific research today.
4. **New Management Career:** in a similar way to the researchers' and technicians' careers, an R&D management career will be created in the CSIC, envisaging various scales and accompanied by the creation of modern systems of promotion and incentivisation for personnel on this career path. The final structure will be set within the framework of the transformation of the CSIC into a state agency.
5. **FORGES Action:** This management training action (*FORmación en GEStión*) is designed to train and qualify CSIC management personnel so they are better able to perform their work. Specific courses will be organised for management personnel focusing on each of the various management problems the institution faces. These courses will be organised into different levels and themes.
6. **e-CSIC Action**: One of the components of the CSIC's management problem vector is related to the antiquated management systems and procedures based on paper documents. Some of these processes have been automated, thanks in many cases to individual efforts rather than coherent and comprehensive planning of the CSIC's management. To address this issue, the CSIC has began to look at updating the hardware, and in particular the software, of its management information systems. It is envis-

The numbers of the CSIC's research support and management personnel will be increased and the training of qualified technical staff promoted. The aim is to achieve more dynamic, less centralised and more agile management, at the same time as enhancing the basic activity of the research groups.

aged that the institution's management will be more efficient as a result of this action.

7. **TELEMACO Action:** Consistent with the preceding action, there is a pressing need to move all the CSIC's internal management to electronic format and simplify the procedures and formalities involved.
8. **Management Structure:** The current situation of the CSIC's centres/institutes makes it advisable that, in certain cases, their management be unified to bring together various small institutes within a single management structure. This is also applicable to common services and maintenance when the institutes involved are physically close. The creation of these management structures is envisaged within the SUSTENA strategic line, and in some cases they will take the form of service centres.

SUSTENTA will also benefit from the **JAE-Technicians programme** and the **technical training courses** in the *EXPERTIA* strategic line. Obviously, the *SUSTENTA* strategic line is closely tied to *RETICULA*. The new centres and institutes envisaged in the framework of this action plan include allocations of research and management support personnel.

RETICULA STRATEGIC LINE

This strategic line refers to the network of CSIC centres/institutes: It rests on almost all the institution's strengths, although S5 (**Nationwide scope**), S3 (**Public Image**), S2 (**Multidisciplinarity**) and S1 (**Research staff**), stand out. Moreover, this strategic line will mitigate some of the CSIC's current weaknesses: W13 (**Inadequate infrastructure**), while increasing its competitiveness in relation to Threat T1 (**Research centres with more advanced management**). At the same time *RETICULA* will exploit a number of the Opportunities available, such as O1 (**Interdisciplinary research**), O5 (**Socio-economic demand for research results**), O2 (**New scientific niches**), O3 (**INGENIO2010 Programme**), O8 (**Observatories of socio-political interest**), O13 (**Well trained researchers**), O4 (**New programmes in the autonomous regions**), and O7 (**Lisbon conference**). The actions envisaged in this strategic line refer to the creation of new centres and institutes. The creation of new centres and institutes is based on the analysis carried out by the Area Commissions on the Spanish science scene in particular areas and axes of activity. These analyses are set out in the various Strategic Plans of the Scientific and Technical Areas

(Volume III) and the actions summarised below derive from them. Some of them centre on topics of current interest and aim to place the CSIC at their forefront.

The creation of these new centres and institutes and the remodelling of existing ones envisaged in this Action Plan is based on the analysis of the Spanish scientific situation in particular areas and axes of activity, undertaken by Area Commissions.

NANO SCIENCE AND NANOTECHNOLOGY AXIS

The study and manipulation of the «nano-scale» world has huge potential and is developing rapidly. Although the CSIC already has research groups in various institutes working on this new discipline, its is important to bolster this axis of activity by creating new institutes, although some will be created with links to existing centres and institutes. The new centres and institutes envisaged are:

- ***Centro de Investigación en Nanociencia y Nanotecnología de Barcelona*** (Barcelona Nanoscience and Nanotechnology Research Centre), **CIN2:** this is a joint centre belonging to *the Instituto Catalán de Nanociencia* (the Catalonian Nanoscience Institute, belonging to the Catalonian University and Regional Government, (*Generalitat de Catalunya*) and the CSIC. It will be located in Barcelona.
- ***Centro de Investigación y Desarrollo en Nanotecnología y Materiales Nanoestructurados de Asturias*** (Asturias Centre for Research and Development in Nanotechnology and Nanostructured Materials)**:** linked to the CSIC's *Instituto Nacional del Carbón* (National Coal Institute), INCAR. this is a joint centre belonging to the Ministry of Education and Science, the *Principado de Asturias* (Asturias Regional Government), the University of Oviedo and the CSIC.
- ***Centro de Nanociencia y Nanotecnología de Madrid*** (Madrid Centre for Nanoscience and Nanotechnology)**:** linked to the *Instituto de Microelectrónica de Madrid* (Madrid Microelectronics Institute, part of the Centro Nacional de Microelectrónica (National Microelectronics Centre)) (IMM-CNM) and the *Instituto de Ciencia de Materiales de Madrid* (Madrid Institute for Materials Science), ICMM. It will be a joint centre bringing together the CSIC, the Madrid Autonomous University (UAM), the Madrid Complutense University (UCM), the Madrid Polytechnical University (UPM) and the *Comunidad Autónoma de Madrid* (Madrid Regional Government).
- ***Centro de Nanociencia de Aragón*** (Aragón Nanoscience Centre)**:** linked to the *Instituto de Ciencia de Materiales de Aragón* (Aragón Materials Sciences Institute). It will be a joint centre with the *Comunidad Autónoma de Aragón* (Aragón Regional Government) and the University of Zaragoza.

- ***Instituto de Ciencias de Materiales del País Vasco*** **(San Sebastián)** (Basque Country Institute of Materials Science)**:** a new institute which entails the expansion of the current Materials Physics Unit. This will be a mixed institute in collaboration with the University of the Basque Country.

FOOD SCIENCE AXIS

Nutrition and new foodstuffs constitute an area in rapid growth. Begun at the CSIC in the 1980s, it has shown itself to be highly fruitful. This axis of activity directly addresses the study of a subject of which the general public is highly aware, namely nutrition and new foodstuffs. This axis will reinforce the creation of the following new centres and institutes:

- ***Centro de Competencia de la Leche y Derivados*** **(Milk and dairy products competence centre) (Oviedo).** Joint centre with the *Principado de Asturias* (Regional Government of Asturias), linked to the *Instituto de Productos Lácteos de Asturias* (Asturias Dairy Products Institute). The Ministry of Education and Science and the University of Oviedo will also be involved in setting up the competence centre.
- ***Instituto de Investigación en Ciencias de la Alimentación*** **(Food Sciences Research Institute), (CIAL) (Cantoblanco-Madrid).** A joint CSIC-UAM institute on the Cantoblanco campus (Madrid). It will initially comprise staff of the *Instituto de Fermentaciones Industriales* (Industrial Fermentations Institute)(IFI) and the *Instituto del Frío* (Institute of Refrigeration)(IF). It will carry out research focusing on the development of safe and healthy foods and ingredients.
- ***Instituto de Tecnología de Alimentos y Nutrición*** **(Nutrition and Foods Technology Institute) (ITAN) (Madrid).** A CSIC institute which will be located within the current *Instituto del Frío* (Institute of Refrigeration), in the *Ciudad Universitaria* university campus in Madrid, after expansion and remodelling of the building. The institute will initially be made up of staff from the *Instituto del Frío* (Institute of Refrigeration) and the *Instituto de Fermentaciones Industriales* (Industrial Fermentations Institute). Its research will be oriented towards the development of food processes and products and human nutrition.
- ***Instituto de Vitivinicultura*** **(Vitiviniculture Institute) (La Rioja).** A new institute that will be set up in conjunction with the regional government and the University of La Rioja. The institute's research will be centred on aspects of food technology

and agrobiotechnology relating to vines and wine. The institute will make it possible to cover a significant gap in the CSIC's presence in this autonomous region, as it previously had only an Associated Institute with the *Instituto de Ciencia de Materiales de Aragón* (Aragón Materials Science Institute).

ENVIRONMENT AND GLOBAL CHANGE AXIS

Preserving the quality of the environment and controlling global change are two of the major challenges humanity will face over the coming decades. This axis of activity is being developed by various CSIC institutes. Its aim is to bolster this research by creating new centres/institutes and units, which will act in a coordinated way to establish an operating network permitting the integrated analysis of these problems. In addition to the existing centres and institutes focusing on these issues, the following new activities are envisaged:

- ***Centro de Investigación sobre Recursos Naturales y Biodiversidad de la Cordillera Cantábrica*** **(Centre for Research into the Natural Resources and Biodiversity of the Cantabrian Mountains) (Oviedo).** This is a joint centre belonging to the *Principado de Asturias* (Asturias Regional Government), the University of Oviedo and the CSIC.
- ***Observatorio del Cambio Global de Las Palmas*** **(Las Palmas Global Change Observatory).** Unit run in collaboration with the University of Las Palmas de Gran Canaria to study the impact of global change on island systems. The *Estación Sísmica de Lanzarote* (Lanzarote Seismic Station) will be updated and linked to this institute.
- ***Instituto Tecnológico del Agua y Medioambiente*** **(Water and Environmental Technology Institute) (Barcelona).** Institute run in collaboration with *Fundación Agbar* (*Aguas de Barcelona*, the Barcelona water company) and the Catalonia Polytechnical University. It is envisaged that this institute will adopt the form of an Economic Interest Group under the ***Agrupaciones de Interés Económico CSIC-Empresas*** action within the TRANSFER strategic line.
- ***Observatorio del Cambio Global de Badajoz*** **(Badajoz Global Change Observatory).** This is a node/joint unit looking at the impact of global change on protected natural spaces and «*dehesas*» (Mediterranean oak-wood pasture) Although currently still at the statement of intentions stage, the centre will be incorporated in the CSIC's global change observatory network (OBSERVATORIOS action in the OBSERVA strategic line). It will be set up in conjunction with the University of Extremadura.

ENERGY AXIS

The obtaining and utilisation of energy represents a series of problems with a considerable environmental, social and economic impact into which a great deal of research effort is being dedicated in the more developed countries, which are also the biggest energy consumers. There are several groups in the CSIC who have been working on this type of problem for some time. With the new actions envisaged in this axis of activity we aim to increase the institution's competitiveness in those areas which may potentially offer solutions to these problems. The following actions are envisaged in this context:

- ***Instituto de Tecnologías de Combustión Limpias de El Bierzo* (El Bierzo Institute of Clean Combustion Technologies) (León).** Participation of the CSIC in a centre for the development of clean technologies in conjunction with other PROs, the University of León, and the Castilla-León regional government.
- ***Centro de Pilas de Combustible* (Fuel Cell Centre) (Puertollano-Ciudad Real).** Pilot plant for the development of fuel cells in collaboration with the university and regional government of Castilla-La Mancha.

CULTURAL HERITAGE AXIS

Spain's history as a melting pot and frontier zone mean it is home to a considerable historical and cultural heritage with unique characteristics which deserve to be studied and protected. In the CSIC there are various institutes that carry out research in this direction, but there are many gaps and grey areas that remain little studied, thus more than justifying the setting up of the new initiatives envisaged in this axis. These are:

- ***Activities at Las Médulas*, Castro Ventosa and Igueña (León)**: Excavation and recovery of Castro Ventosa (Cacabelos), Igüeña paleontological/archaeological field station and integrated management centre for the Las Médulas nature and culture area. These actions are part of a unified effort to make the most of the cultural heritage of this region of Castilla-León.
- ***Centro de Ciencias del Patrimonio Cultural* (Cultural Heritage Sciences Centre) (Santiago de Compostela-A Coruña)**: this centre needs to consolidate its position in the national and international context as a benchmark unit in the field of research into cultural heritage and its sustainable management. To make this possible the centre will be given an interdisciplinary scientific and technological structure, fully able to study technologies for the analysis,

evaluation, conservation and exploitation of the built environment, urban spaces, the buildings and objects that make up the cultural heritage, and historic and cultural landscapes.

BIO AXIS

Health is one of human beings' greatest concerns. It is not surprising, therefore, that some of the greatest research efforts in many countries around the world are focused on biomedical and health sciences. Good health is an essential precondition for all economic, intellectual, social or leisure activities. At the CSIC, as in all the world's major research institutions, considerable efforts and resources have been devoted to research in these areas. However, it is still necessary to bolster this activity with new actions such as those enumerated below. Given the obvious relationship, all those activities relating to biology and the study of life, of which health and human life are just a specific instance, are included in this axis.

- ***Instituto de Biotecnología y Señalización Celular*** **(Biotechnology and Cellular Signalling Institute) (Cantabria).** New institute which will be integrated in a joint centre with the university and regional government of Cantabria. This institute will be located in the Santander technology park.
- ***Instituto de Medicina Predictiva de Barcelona*** **(Barcelona Preventive Medicine Institute)** Joint centre in collaboration with the *Departament d'Universitats, Recerca i Societat de la Informacio* (DURSI) and the University of Barcelona.
- ***Instituto Medicina Molecular Príncipe de Asturias*** **(Prince of Asturias Molecular Medicine Institute) (IMMPA) (Alcalá de Henares-Madrid).** Joint institute with the University of Alcalá de Henares, the Madrid regional government, and the Hospital Príncipe de Asturias, Alcalá de Henares.
- ***Centro Física Médica*** **(Medical Physics Centre) (Valencia).** A joint centre in which the CSIC, the Ministry of Education and Science, the *Generalitat de Valencia* (Valencia regional government) and several hospitals are involved.
- ***Centro de Investigación y Tecnologías de la Vida*** **(Life Technologies Research Centre) (Santiago de Compostela):** joint centre with the University of Santiago de Compostela. Its activity will be to bolster high scientific competence areas and infrastructure related to biomedical research, with particular emphasis on the development of new therapeutic and pharmacological strategies.

- ***Estación de Montaña de León*** **(León Mountain Station)** creation of a new mountain station linked to the Leon Experimental Agriculture Station, in collaboration with the «Valle del Esla» industrial corporation and the regional government of Castilla-León. It is envisaged that this institute will adopt the form of an Economic Interest Group (*Agrupación de Interés Económico*) under the ***Agrupaciones de Interés Económico CSIC-Empresas*** action within the *TRANSFER* strategic line.
- ***Laboratorio CSIC-IRTA de Genética Molecular Vegetal*** **(CSIC-IRTA Plant Molecular Genetics Laboratory):** new centre in the CSIC-IRTA (*Institut de Recerca i Tecnologia Agroalimentària*) consortium, focusing on agrogenomic research.

INFORMATION SCIENCE AND TECHNOLOGIES AXIS

Information and communications technologies (ICT) increasingly permeate all the activities of society and individuals. The development of these technologies is a path with considerable potential which the CSIC should not overlook. Within this axis of activity, in addition to the institutes and centres that already focus on this area, the following initiatives are proposed within the CSIC:

- ***Centro de Automática y Robótica de Albacete*** **(Albacete Robotics and Automation Centre).** Centre associated with the *Instituto de Automática Industrial de Madrid* (Madrid Institute of Industrial Automation). This is a joint centre with the university and regional government of Castilla La Mancha.
- ***Centro de Investigación Aplicada en Tecnología Computacional y Modelizacion Matematica*** **(Centre for Applied Research in Computing Technology and Mathematical Modelling):** A joint CSIC-CESGA (*Centro de Supercomputación de Galicia*) centre which will promote integration with scientific units offering scientific excellence in universities to develop research capabilities and activities, and advanced services in the sphere of high performance computing technology and applied numerical modelling.

PHYSICS AND MATHEMATICS AXIS

This activity brings together activities related to Physics and Mathematics. The following new centres and institutes are envisaged within this axis:

- ***Instituto de Ciencias Matemáticas*** **(Mathematical Sciences Institute):** Joint institute with the Madrid Autonomous University, the Madrid Carlos III University and the Madrid

Complutense University which will be located on the campus of the Madrid Autonomous University.

- ***Instituto de Astrofísica Espacial* (Space Astrophysics Institute):** Joint institute linked with the European Space Astronomy Centre (ESAC) and the European Space Agency (EA), and in collaboration with the *Instituto Nacional de Técnica Aeroespacial* (National Institute of Aerospace Technology) and the CDTI. It will be centred on research on astrophysics missions and exploration of the solar system.
- ***Instituto de Física Interdisciplinar* (Interdisciplinary Physics Institute) (Balearic Islands):** Joint centre with the University of the Illes Balears.
- ***Instituto de Matemáticas y Física Teórica* (Institute of Mathematics and Theoretical Physics):** Joint centre with the Madrid Autonomous University. It brings together the current *Instituto de Física Teórica* (Theoretical Physics Institute) and the future *Instituto de Ciencias Matemáticas* (Institute of Mathematical Sciences). It will be a services centre providing the management structure to both institutes.

SPECIAL ACTIONS

- **«Colina de los Chopos» Project:** this project has the goal of transforming the so-called «Colina de los Chopos» in Madrid into a cultural space that links up with the axis of the city's museums along the Paseo de la Castellana. The project involves extending the *Museo Nacional de Ciencias Naturales* (National Natural Sciences Museum) and relocating some of the CSIC's research centres and institutes from its Calle Serrano campus.
- ***Centro de Ciencias de Benasque* (Benasque Science Centre).** A foundation whose trustees are the Benasque town council, the University of Zaragoza, the Aragón regional government and the CSIC. Its aim is to run meetings between researchers in various fields of knowledge. With the participation of the Ministry of Education and Science, a new building will be constructed for the centre in the near future.
- ***Centro de Encuentros Ignacio Bolivar* (Igancio Bolivar Meeting Centre).** A centre located in the Sierra de Guadarrama, in the Madrid Autonomous Region, the purpose of which is to host conferences, seminars, schools and workshops and other kinds of meetings between researchers, technicians and managers in the sphere of science and technology. The centre will serve all the CSIC's institutes.

The CSIC devotes considerable effort to training new researchers and produces more than 7% of the doctoral theses defended each year in Spain. As well as taking in research fellows and contract employees under external programmes (national, international, regional, foundations, etc.) the CSIC runs a number of training programmes of its own (at pre-doctoral, postgraduate, post-doctoral and technician levels).

EXPERTIA STRATEGIC LINE

Although its mission is research, without a specific teaching role, the CSIC must not overlook aspects of highly specialised training. The actions envisaged in this strategic line are related to activities to train research personnel as experts in scientific topics, technologies or areas of knowledge. One of the characteristics of the CSIC, and moreover, one of its strengths (S4) is its «**Pool of researchers».** Indeed, as mentioned in the Strengths section of the SWOT analysis (Chapter 3), the CSIC is one of the country's most important nuclei for the training of high quality researchers. With EXPERTIA we aim to continue this training activity by encouraging new research personnel to join the CSIC at an earlier stage. Moreover, EXPERTIA aims to develop the potential of CSIC in the training area by exploiting the opportunities available to it from the context in which it operates: O12 (**New scientific personnel programmes**) and O10 (**Specialist masters' degrees**). This strategy line will also serve to mitigate one of the weaknesses of the institution, W10 (**Lack of participation in university postgraduate courses**) and one of the threats it faces, T4 (Exclusion from academic circles).

The actions envisaged in EXPERTIA do not apply only to research staff but to other personnel (technicians) and audiences outside the institution that need expert training on one of the scientific areas in which the institution is active. The actions envisaged in this line are:

1. **CSIC-UIMP postgraduate programme:** the extensive experience of the CSIC in the training of research staff at postgraduate level has always involved cooperation with a variety of Spanish universities. Its high level of efficiency was highlighted in the section on the SWOT analysis and reliably shows the capacity of the CSIC's researchers, and the institution in general, to train PhDs. During the period this Action Plan is in effect, a CSIC-UIMP postgraduate programme will be set up, in conjunction with the Menéndez y Pelayo International University (UIMP). The quality of the training and the stringent entrance requirements will be the trademark of this programme. However, it should also be noted that the CSIC's cooperation agreements on postgraduate studies with all Spain's universities will continue to be maintained and developed. This action envisages the organisation of postgraduate and specialisation courses as an essential complement to the CSIC-UIMP postgraduate programme. The CSIC's postgraduate and specialisation department will be responsible for these courses. The post-graduate courses envisaged include masters' degrees with the aim of transmitting the CSIC's broad base of acquired

know-how in various fields to professional sectors. The topics of these masters include: knowledge transfer, international research management, and communicating science to society.

2. **Technical training courses:** The Training Office (*Gabinete de Formación*) will be in charge of these courses, which will have a primordially technical content and will be aimed at the institution's personnel. The aim is to train and qualify the CSIC's technical staff so they are able to perform their work more effectively. The success of these courses in the past and the impact they have on the training of technical and management personnel reveal that it is worth not just keeping them but bolstering them in the framework of the action plan.
3. **Predoctoral Training Grants-Contracts Programme:** the aim is to implement a 2+2 structure (2 years of grant plus 2 years of contract employment) under the new Statute of Trainee Research Personnel (Royal Decree 63/2006, 27 January. BOE nº. 29, 3/2/2006 pp. 4178-4182). The intention is to put this format in place for all trainee researchers at the CSIC, whether they come from the CSIC's own programmes or duly recognised external programmes.
4. ***JAE-Predoctoral* programme**: The heir to the I3P programme, the JAE-predoctoral programme will maintain and strengthen the previous programme of predoctoral grants, promoting them to pre-doctoral contracts in accordance with the 2+2 format.
5. ***JAE-Postgraduate* programme**: This programme will be the equivalent of the previous I3P-Postgraduate grants programme, but will be turned into 1 year long contracts, with the possibility of their extension to 2 years.
6. ***JAE-Technicians* programme**: This training programme aimed at technicians at different levels and with different qualifications is the continuation of the I3P-Technicians programme run in previous years. The structure of assignment of contracts and contracting will remain similar to that at present, with an increase in the numbers available.

The institution's image affects practically all the activities it performs. It is a priority target and of high strategic importance to improve the institution's good public image.

IMAGEN STRATEGIC LINE

The CSIC's **Public Image** (S3) is its greatest strength and earns a positive assessment in almost all spheres: social, political, scientific, national and international. Although its strategic value is not the highest among the CSIC's strengths, it has the greatest synergistic impact. This is due to the way the image of the institution affects almost all the activities it undertakes. Obviously, a good image draws good scientists to the CSIC,

In recent years, communication between science and society has become a priority goal of all institutions dedicated to research.

companies see it as a possible ally and/or solution to its R&D problems, it has an impact on evaluation processes for the funding of research from competitive funds as it represents a guarantee of the proposed research's being completed, society sees it as a benchmark for knowledge and on science and technology subjects, the political authorities can justify their actions when they are backed by the seal of approval of the CSIC, etc. It is a priority target and of high strategic importance to **improve the institution's good public image**. For this purpose, the following actions have been established within this Strategic Line:

1. ***VISIBILIDAD* Action:** This action sets out to raise the profile of the CSIC in the media as described in the Communication Department's strategic plan.
2. ***CONFIANZA* Action:** This action aims to preserve the scientific rigour and integrity of the CSIC, which are the source of its good image with the scientific community and the public in general. To do so, procedures will be put in place to ensure and guarantee that the research conducted in the CSIC comes up to the highest standards of integrity. The following objectives are included in this action:
   - **Ethics Committee**: the Ethics Committee will oversee that the rules of ethics and conduct on subjects relating to experimentation, research groups, relations between staff, publishing of results, etc. which, although they are not legally binding are a sign of the identity of the institution, are adhered to.
   - **Manual of Good Practice:** the CSIC currently lacks a manual of this kind, which is customary in many modern research organisations. During the period in which this Action Plan is in force, a CSIC manual of good practice will be drafted, under the aegis of the ethics committee.
   - **Style Manual:** along the same lines as the preceding objective, a Style Manual will be drafted so as to make it easier to ensure a common corporate image whenever the CSIC's researchers appear in the media. The Communication Department will be responsible for preparing this manual.
3. ***YO-CSIC* Action:** This action is aimed at fostering a corporate spirit among the CSIC's personnel. Although the institution enjoys a good external image, its image with its staff is not always so positive. The aim of *YO-CSIC* is to improve the internal view of the CSIC among its employees. For this purpose the institution will use its good public image to achieve social advantages for its staff. It will also bolster the activities of the Social Action Department so they reach a larger number of employees.

DIVULGA STRATEGIC LINE

This strategic line will make use of Opportunity O9 (**Popular science programmes**) and is directly related to the *IMAGEN* strategic line discussed in the preceding section. The aim of *DIVULGA* is to bolster the activities of the CSIC in the dissemination of scientific culture and the popularisation of science being carried out by the Scientific Culture Area. This strategic line therefore envisages the following actions:

1. **Creation of a Scientific Culture Unit:** Given the importance that communicating science has acquired, and the level of infrastructure that this calls for, the CSIC needs a unit specifically devoted to this task. This unit will coordinate the tasks of communicating science, scientific extension and supporting the promotion of scientific culture. In order for it to operate properly it will have a flexible and decentralised structure so as to allow staff linked to the unit to be based at other geographical locations. The Scientific Culture Unit's initiatives include the organising of the **Fourth International Congress on the Social Communication of Science,** previous editions of which were held in Granada (1999), Valencia (2001), and A Coruña (2005). This edition of the congress (Madrid, 21 to 23 November 2007) sought to emphasise the more academic aspects, research and reflection, as well as the international dimension of exchange and collaboration between organisations and institutions dedicated to the social communication of science in other countries. Also, a series of actions linked to the teaching of science at junior, primary and secondary education levels, will be coordinated, so as to back up initiatives already in progress, such as «*El CSIC en la Escuela*» (CSIC in schools).
2. **Master in Communicating Science to Society:** The lack of personnel trained in scientific communication, and the weight of scientific journalists with varied training in the field of popularising science, make it necessary to offer the media with complete high quality training on communicating science to society. The Master's degree will include both theory and practice, comprising visits to scientific centres producing scientific knowledge and training in communicating specific or sectoral scientific content. It is aimed at higher graduates and PhDs with an interest in popularising science.
3. **Institutional publications and audiovisual productions:** The aim is to create a stable and up-to-date line of institutional publications and audiovisual productions with information about

Scientific research can only be conceived of in an international framework. The CSIC is making an effort to extend its international reach by opening up new horizons for the institution and its research.

the CSIC's activities and projects. All the publications will be bilingual (Spanish and English). These will include: the institute's report, DVDs, thematic brochures for a general audience, and brochures giving institutional information. The presence of the CSIC will also be promoted in the media through agreements to raise the institution's profile on the radio and television, and to introduce scientific content into programme scheduling.

HORIZONTES STRATEGIC LINE

This strategic line groups together all the actions aimed at internationalising the CSIC. As mentioned in the section on the SWOT analysis, one of the CSIC's weaknesses is the **small number of foreign researchers** (W15), and one of the threats it faces is the **Loss of internationalisation** (T7). *HORIZONTES* is intended to tackle both negative factors by taking advantage of some of the CSIC's opportunities, such as O14 (**CSIC in international organisations**), O16 (**Cooperation with PROs in other countries**), O15 (**Interface between the EU and Latin America**), and O17 (**Presence of the CSIC abroad**). It is clear that the institution has an abundance of possibilities for international development, but that these will undoubtedly consume large quantities of resources. The CSIC needs to make a strong commitment to developing these lines of action while at the same time trying to situate itself among the front runners among leading countries in R&D worldwide. At the same time, through actions bringing mutual benefits, support the development of research in other, less developed, countries and benefit from the work of these researchers by encouraging them to join the CSIC on a temporary basis. Although they are coordinated by the International Relations Division, the scope of the actions in this strategic line is such that they affect all the CSIC's structures.

The actions envisaged in *HORIZONTES* will be put into effect over the course of the Action Plan's lifetime, although in some cases, given their scale, it is not envisaged that they will be completed during this period. These actions are:

1. **CSIC «Honorary Chairs»**: These will allow senior researchers to join the CSIC temporarily or permanently and form part of its research groups, thus bringing the institution the benefits of their knowledge and experience acquired outside of Spain.
2. **Joint Institutes:** Top quality scientific research cannot be conceived of today except in an international context. One shortcoming of the CSIC today is its low international profile, particu-

larly in countries that are world leaders in research. The aim of this new stage is to create joint institutes in conjunction with scientific institutions in various countries, both in the EU and elsewhere. These institutes will be hybrids of the CSIC and the foreign institution and will be funded jointly by both. This type of institute will enable real and direct collaboration between institutions in ways that would not otherwise be possible, or which in the best of cases, would be highly volatile. The number of institutes of this type and the countries in which they are to be based have yet to be defined, as have the partner institutions.

3. **CSIC «Outstations»:** From the strategic point of view it is of interest to the CSIC to set up research institutes (either alone or as joint institutes) in a number of countries which offer the institution and its researchers particular advantages on account of their individual characteristics. These institutes would be similar to joint institutes, but without the need for a partner institution in the host country. An example of this type of CSIC «Outstation» is the existing *Escuela Española de Historia y Arqueología* (Spanish School of History and Archaeology) in Rome.

4. **CSIC overseas aid:** To facilitate the mobility of researchers to CSIC joint institutes and CSIC outstations, a programme of aid will be set up for pre- and post-doctoral researchers joining these centres for short or medium length periods but who keep their links with the Spanish centre/institute. This aid will be compatible with contracts and remuneration received by these researchers at their institute of origin. In the case of joint institutes, the aid may be co-financed by the joint institute. This aid may also be used by CSIC researchers at the joint institute's centre abroad to finance study visits to CSIC centres in Spain.

5. **Master in International Research Management:** Teaching an international research master is envisaged so as to make it possible to train future managers of international research programmes. International research programme managers are in short supply in Spain but highly necessary as research funding becomes globalised and more international. This master's degree will be taught in conjunction with the Technology Transfer Office, which will deal with topics most closely related to the protection of intellectual property rights and research results at the international level, and management of research contracts with foreign or multinational companies. This master's degree will be set within the context of the **Masters** action under the *EXPERTIA* strategic line.

6 RESOURCES NECESSARY AND PROGRESS INDICATORS

ESTIMATED BUDGETS

The execution of the strategic lines described in chapter 6 of this volume, and those indicated in the strategic plans of the horizontal units (Volume II), Scientific-Technical Areas (Volume III) and the centres and institutes (Volume IV), requires the CSIC budgets for the lifetime of the Action Plan that are estimated below. In general terms, a sustained increase of 25% a year is considered necessary over the lifetime of this Action Plan. The estimated ordinary budget, broken down by years, is shown in table 6.1.

TABLE 6.1

ESTIMATED ORDINARY BUDGET OF THE CSIC FOR THE PERIOD 2006-2009

Chapter	2004	Δ (%)	2005	Δ (%)	2006	Δ (%)	2007	Δ (%)	2008	Δ (%)	2009
I	257,091	4	267,444	11.2	297,531	7.2	318,972	7.5	342,895	7.5	368,612
II	36,526	3.8	37,908	15.3	43,699	24.9	54,562	25	68,202	25	85,253
III	0.33	0	0.33	0	0.33	0	0.33	0	0.33	0	0.33
IV	2,149	5	2,257	57.6	3,556	20.5	4,284	20	5,140	20	6,168
VI	77,845	19.2	92,775	35.5	125,737	59.7	200,859	47	295,263	41	416,321
VII	6,129	82.4	11,181	24.9	13,964	75.1	24,448	70	41,561	60	66,497
VIII	645	0	645	0	645	0	645	0	645	0	645
IX	2	-	-	-	0	-	300	0	300	0	300
Total	**380,387**	**8**	**412,209**	**18**	**485,133**	**25**	**604,069**	**25**	**754,007**	**25**	**943,797**

Figures in thousands of euros.

Justification of the Budget

The budgetary increases envisaged are justified by the initiatives we aim to commence during the lifetime of this Action Plan. The budgetary increases are concentrated primarily in chapters I, II, VI and VII. Chapter IV (Current Transfers) has increased considerably (by approximately 20%), but relative to the other budgetary items it does not represent a significant amount. The estimates for each of the chapters are explained below.

Chapter I (Staff costs): For this chapter an increase of 7.2% a year is proposed as of 2007. Given that this chapter is destined to personnel, any increases to it will depend on the increase in the total estimated CSIC workforce, envisaged in the following section. The proposed recruitment of public servants listed in 6.2 entails a relative increase in the CSIC's workforce of 4.9% in 2007, 5.5% in 2008 and 5.7% in 2009, considering the workforce as a whole.

Chapter II (Circulating assets and services): This chapter refers to the basis expenses involved in operating the CSIC's facilities. Although the increase in this chapter is around 25%, the total quantity represented by this chapter in the total CSIC budget is comparatively small (close to 9% of the total). The proposed increase is explained by the new centres and institutes envisaged in the *RETICULA* strategic line. In effect, these new institutes and facilities will entail an increase in the current expenses entailed by the maintenance and operation of the CSIC's buildings and installations. Moreover, the expenses relating to the operation of existing centres and institutes have risen over recent years at a rate faster than growth in this chapter of the budget. This has meant that in some cases the CSIC's institutes and centres have had to do without basic services as a result of a lack of funding, in detriment to the optimal working conditions, or they have had to pass on these operating expenses to the funding obtained by researchers (basically the part associated with overheads), which has led to a degradation in the capacity of the centre/institute to perform scientific research.

Chapter III (Financial expenses): This chapter is small in relation to the total budget and it is not envisaged that it undergo changes over the course of the period in which the Action Plan is being executed. These expenses relate to charges for the administration of the CSIC's bank accounts.

Chapter IV (Current Transfers): An increase of 20% is proposed for this chapter as of 2007. The total volume allocated to this heading remains small in relation to the total budget (around 0.6% of the total). The proposed increase is explained by the CSIC's policy of creating incentives for relationships with other institutions which in many cases represent expenses, either as participation quotas or collaboration expenses. It is important not to overlook these activities, if as the institution intends, the CSIC is to play a structuring role in the Spanish science and research system.

Chapter VI (Real investments): After Chapter I, this chapter is the most significant in the CSIC's budget. Moreover, it is one that will increase over the lifetime of the Action Plan. This is fundamentally due to the new initiatives proposed in the *FRONTERA*, *TRANSFER*, and *OBSERVA* strategic lines, and part of *SUSTENTA, RETICULA, DIVULGA* and *HORIZONTES*. These lines envisage various actions oriented towards increasing the competitiveness of the CSIC's centres and institutes, and to build several (over thirty)

new centres and institutes and refurbish some of the existing ones. Many of these initiatives are high cost, as is normal for today's research centres if they are intended to be competitive on a world level.

Chapter VII (Capital Transfers): Although this chapter is small in comparison with the total budget (between 3 and 7%, approximately), it is, however, that which is expected to undergo the greatest increase (around 60-70% a year). This chapter funds part of the initiatives relating to the contracting of trainee staff (JAE programmes). These actions aim to have a big impact on the line of the CSIC's mission as a trainer of researchers, which has made it an important seedbed for researchers in the national scientific system.

Chapters VIII and IX (Financial Assets and Liabilities, respectively): These two chapters involve small amounts and are relatively insignificant in the proposed budget. Almost no increase is envisaged and the amounts put forward are the minimum necessary to cover the needs of the institution for these items.

ESTIMATED HUMAN RESOURCES

An adequate allocation of human resources over the lifetime of the plan is essential for the optimal execution of the CSIC's 2006-2009 Action Plan. It is necessary to increase the number of positions assigned to CSIC scientific personnel (tenured scientists, scientific researchers, and research professors). It is also essential that human resources needs in terms of research support technicians are met. A serious weakness of the institution is its limited number of technicians. These personnel are essential in order for research to be carried out properly as they preserve the «technical memory» of the laboratories and research groups, which are often made up of staff with rapid rates of rotation, such as research fellows and researchers on short-term contracts. It is also necessary to increase the numbers of management personnel considerably. The complexity of managing international and national research and the volume of management work done by the CSIC's centres and institutes, as well as by the institution's central services, make it essential to make up the institution's shortcomings in terms of staff of this kind. Globally, the new human resources for the years the current Action Plan is in force are shown in table 6.2.

TABLE 6.2

FORECAST NEW HUMAN RESOURCES IN THE CSIC
FOR THE PERIOD 2006-2009

	2006	2007	2008	2009	TOTAL
Research staff	**219**	**300**	**330**	**359**	**1,208**
Tenured scientists at the CSIC	200	275	300	325	**1,100**
Research scientists at the CSIC	11	15	18	20	**64**
Research professors at the CSIC	8	10	12	14	**44**
Research support technicians	**95**	**220**	**240**	**260**	**815**
CSIC higher scientific officers	20	60	70	80	**230**
PRO intermediate specialist technicians	40	60	70	80	**250**
PRO research assistants	35	100	100	100	**335**
IT and management staff	**12**	**120**	**145**	**170**	**447**
National govt. administration managers	6	25	30	35	**96**
National govt. administration administrators	0	50	60	70	**180**
National govt. information and systems managers	4	25	30	35	**94**
Aux. national govt. IT technical	2	20	25	30	**77**
Totales	**326**	**640**	**715**	**789**	**2,470**

INDICATORS OF EXECUTION

In order to measure the degree of execution of this Action Plan and the impact on the CSIC's output of the strategies defined in the CSIC's General Strategic Plan, contained in this volume, and the strategic plans of the horizontal units (Volume II), Scientific and Technical Areas (Volume III), and Centres and institutes (Volume IV), according to the general objectives stated in its mission and vision, the following indicators of execution have been defined, for which the target values are set out in table 7.1.

The indicators of execution have been selected on the basis of each of the main overall objectives of the institution.

Basically four main areas of activity may be distinguished:

- Obtaining of external resources for research
- Scientific output, in terms of publications
- Technological output, in terms of patents, technology-based firms and technology service units
- Training of research personnel

Indicator of external resources

This indicator is constructed as the sum of the total external funding for research received by the institution through:

- National and international, public and private (Foundations) competitive projects
- Contracted research (research contracts) with the public sector
- Contracted research with the private sector

Indicators of scientific output

These indicators refer to the number of publications generated by the CSIC's research. Here it is necessary to distinguish several different types of publications:

- Publications in journals indexed by the ISI (Institute for Scientific Information)
- Publications in international journals not indexed by the ISI
- Publications in national journals not indexed by the ISI
- Books (complete works, rather than chapters or conference proceedings, except those that require peer review).

Indicators of technological output

These indicators refer to the CSIC's capacity to transfer the results of its research to the productive sector. They are measured on the basis of the following parameters:

- Number of patents applied for giving national coverage
- Number of patents applied for giving international coverage
- Number of patents licensed to companies
- Number of high-tech start-ups and spin-offs and technology service units created by CSIC staff.

Research personnel training indicator

This indicator relates to the CSIC's activity in the training of new researchers, measuring the number of doctoral these submitted each year.

TARGET VALUES

The proposed target values of the indicators of execution are shown in table 6.3 and have been estimated assuming target specific indices of annual growth for each of them, as explained below. Table 6.4 shows the accumulated total after the period in which the Action Plan is in force (2006 to 2009) and the percentage growth compared to 2005 values.

TABLE 6.3

TARGET VALUES OF THE EXECUTION INDICATORS OF THE CSIC 2006-2009 ACTION PLAN

INDICATOR	2005	Δ%	2006	Δ%	2007	Δ%	2008	Δ%	2009
Income from external funding (€'000)	187,504	10	206,254	10	226,880	10	249,568	10	274,525
Articles in ISI-indexed journals	5,444	6.8	5,811	7	6,218	7.7	6,694	8.1	7,236
Articles in international non-ISI-indexed journals	882	3	908	3	936	3	964	3	993
Articles in national non-ISI-indexed journals	799	3	823	3	848	3	873	3	899
Books	393	3	405	3	417	3	429	3	442
National patents applied for	109	5.5	115	16	133	17	155	29	200
International patents applied for	64	9.4	70	33	93	26	117	20	140
Patents licensed to companies	21	19	25	20	30	27	38	32	50
Start-ups	10	10	11	9.1	12	17	14	14	16
Doctoral theses	553	10	608	10	669	10	736	10	810

TABLE 6.4

ACCUMULATED VALUES OF THE EXECUTION INDICATORS AND PERCENTAGE GROWTH AT THE END OF THE CSIC'S ACTION PLAN 2006-2009

INDICATOR	Total 2006-2009	Δ% 2009 vs 2005
Income from external funding (€'000)	957,227	46.4
Articles in ISI-indexed journals	25,960	32.9
Articles in international non-ISI-indexed journals	3,801	12.6
Articles in national non-ISI-indexed journals	3,443	12.6
Books	1,693	12.6
National patents applied for	603	83.4
International patents applied for	420	118.9
Patents licensed to companies	143	138.1
Start-ups	53	60.1
Doctoral theses	2,823	46.4

Justification of the proposed target values

As indicated above, the proposed target values for each indicator imply an inter-annual increase which varies according to the indicator used. The reason for these differences lies in the characteristics of the indicators.

- **External funding:** a sustained inter-annual increase of 10% is proposed. The external funding obtained depends not only on how effectively the institution executes its Action Plan, but also to a large extent on factors external to it, such as the national and regional budgets devoted to research and the funding schemes of the various research funding agencies. The proposed objective is considered reasonable bearing in mind the estimated growth of the research workforce and the interval (three years in the case of the National R&D Plan) between applications for research projects.
- **Articles in ISI-indexed journals:** this is the main indicator of scientific output, as it refers to those journals of highest average quality (compared with non-indexed journals), although this depends greatly on the area of knowledge concerned. The proposed inter-annual growth of this indicator in 2006 is 6.75%, 50% higher than the average growth seen in 2005 (which is estimated to have been 4.5%). In subsequent years, growth increases to 10% a year with respect to the year of reference, 2005 (4.5%). Thus, in 2007 this indicator should have grown by 60% with respect to the reference, imply a growth of 7% in the number of ISI-indexed publications with respect to 2006. For 2008 and 2009, the increases in growth with respect to the reference year (2005) will be 70% and 80%, respectively. This implies growth of 7.65% and 8.1%, respectively, in the number of ISI-indexed publications in 2008 and 2009, with respect to the previous year, respectively. It is important to note that the growth in scientific output, as measured by this indicator, always lags the improvement measures adopted by an estimated 5 to 10 years. The length of this delay is due to the fact that experiments can take a long time to produce results, particularly when starting new activities which require an extensive and intensive investment of effort before any measurable output is produced. Moreover, increases in research funding only show up in increased scientific output when a particular threshold is reached. The threshold is determined by various factors, such as the increased cost of research, the need for ever more expensive equipment, greater competitiveness, etc. Funding below this threshold not only fails to produce an effec-

tive increase in scientific output, but can actually reduce it. For this reason, the proposed target values for this indicator, and the inter-annual increases they represent, are considered to be very ambitious given the increased funding envisaged. At the same time, it is necessary to bear in mind that an increase in publication quality is often associated with a decrease in their number. Although the quality of publications is not considered in this indicator on this estimate, we intend to introduce this element of valuation during the execution of this Action Plan. The combined quality-quantity indicator will be, without doubt, a more appropriate indicator, which will be adopted once it is available.

- **Articles in national and international non-ISI-indexed journals:** for these indicators a sustained inter-annual growth of 3% is proposed. These are not the highest quality indicators with which to measure the institution's scientific output. In fact, the intention is to reduce the number of publications in journals of this type and to encourage publication in higher quality, indexed journals. Bearing in mind that the percentage increase in publications in indexed journals is greater, and moreover, the absolute value of these publications is considerably greater than that of non-indexed journals, a sustained growth of 3% is indicative of a tendency to reduce the absolute number of publications of this type and, therefore, to increase the quality of the CSIC's scientific output.

- **Books:** sustained inter-annual growth of 3% is proposed for this indicator. It should be noted that writing a book is a much more time consuming process than writing an article for a journal. Therefore the number of books per researcher is much smaller. Moreover, books are a type of scientific output that is highly dependent on the area of knowledge considered, given that, in many cases, books only represent compilations or reviews of well established topics. In other areas, however, books entail more of an original contribution from their authors than articles in journals.

- **Indicators of technological output:** for these indicators we propose high growth figures, indicative of the CSIC's commitment to develop this area of activity. Of all these indicators, the one with greatest qualitative value is that of patents licensed to companies, given that it indicates what patents can really be exploited at any given time. It is worth highlighting that it is for this indicator that the highest inter-annual growth rate has been proposed.

- **Research personnel training indicator (these):** this indicator has a response time of approximately four years. This is the average time taken to write a doctoral thesis. Therefore, any measure creating incentives to train PhD students can only be measured after it has been running for four years. For this indicator a sustained inter-annual growth of 10% is proposed over the lifetime of the Action Plan. This value is considered very ambitious, although all the measures envisaged in the CSIC's Action Plan for 2006-2009 will only bear fruit once it has ended.

ANNEX

COMPOSITION OF THE ADVISORY COMMITTEES ON CENTRES' AND INSTITUTES' STRATEGIC PLANS

HUMANITIES AND SOCIAL SCIENCES AREA

Panel 1.1. (Madrid)

Peter INGWERSEN (Chair)
Department of Information Studies
Royal School of Library and Information Science. London
England (UK)

Christian LEFEVRE
Laboratoire Techniques, Territoires et Sociétés (LATTS)
Ecole Nationale des Ponts et Chaussées (ENPC).
Université Paris 8. Marne-la-Vallée
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Emily GRUNDY
Centre for Population Studies
London School for Hygiene and Tropical Medicine.
University of London. London
England (UK)

Rossella PALOMBA
Institute of Research on Population and Social Policies
Italian National Research Council. Rome.
Italy

Gerard A. PFANN
Department of Econometrics and Department
of Organization and Strategy
Universiteit Maastricht. Maastricht
Belgium

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Centre for Science and Technology Studies (CWTS)
Leiden University. Leiden.
The Netherlands

Ben MARTIN
SPRU - Science and Technology Policy Research
The Freeman Centre. University of Sussex. Brighton
England (UK)

Panel 1.2 (Madrid)

Jacques DUBUCS (Chair)
Département «Hommes et Sociétés» du CNRS.75016 Paris
France

Bruce KAPFERER
Faculty of Arts, University of Bergen
Lauritz Melzers Hus. Bergen
Norway

Hans-Jörg RHEINBERGER
Max Planck Institute for the History of Science. Berlin
Germany

Eberhard KIENLE
Directeur de l'Institut de Recherche
sur le Monde Arabe et Musulman
CNRS - Universite de Provence. Aix-en-Provence
France

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Scotland (UK)

Maurice KRIEGEL
Centre d'études juives à l'EHESS. Paris
France

Alessandra AVANZINI
Dipartimento di Scienze Storiche del Mondo Antico. Pisa
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Jean-Pierre ETIENVRE
Institut d'Études hispaniques
Université Paris Sorbonne-Paris IV. Paris
France

Laura MINERVINI
Dipartimento di Filologia Moderna
Università di Napoli Federico II. Napoli
Italy

Panel 1.3 (Madrid)

Hans Erich BOEDEKER (Chair)
Institute of History
Max Planck
Germany

William SHEA
University of Padua
Galileana Chair in the History of Science. Padua
Italy

Kristian KRISTIANSEN
Archaeology
University of Gothenburg. Gothenburg
Sweden

Henk F. MOED
Centre for Science and Technology Studies (CWTS)
Leiden University. RB Leiden
The Netherlands

Gerard CHASTAGNARET
Contemporary History
University of Provence
Director of the Casa de Velázquez
Madrid

Michel BERTRAND
University of Toulouse Le Mirail
CNRS, Toulouse
France

BIOLOGY AND BIOMEDICINE AREA

Panel 2.1 (Madrid)

Frank GANNON (Chair)
EMBL. Heidelberg
Germany

Walter NEUPERT (Chair)
Adolf-Butenandt-Institut für Physiologie
Chemie der LMU. Munich
Germany

Jan TAPLICK
EMBL. Heidelberg
Germany

Bertrand SERAPHIN
CGM-CNRS
Gif sur Yvette Cedex
France

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Brain Research Institute
University of Zurich. ETH Zurich
Switzerland

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Institut für Genetik
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IRBM P. Angeletti
Pomezia (Rome)
Italy

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Inst. of Life Sciences
The Hebrew University of Jerusalem
Givat Ram. Jerusalem
Israel

Joel VANDEKERCKHOVE
Department of Biochemistry
University Ghent. Ghent
The Netherlands

Nicholas HASTIE
MRC Human Genetics Unit
Western General Hospital. Edinburgh
Scotland (UK)

Werner KUEHLBRANDT
MPI für Biophysik
Dept. Structural Biology. Frankfurt am Main
Germany

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Institut für Genetik und Mikrobiologie
Lehrstuhl für Mikrobiologie der Universität München
Germany

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GBF. Braunschweig
Germany

Andrea BALLABIO
Telethon Institute for Genetics and Medicine
Naples
Italy

Christopher J. LEAVER
University of Oxford. Oxford
England (UK)

NATURAL RESOURCES AREA

Panel 3.1 (Madrid)

Todd STUESSY (Chair)
Botanical Garden
University of Vienna
Austria

Ian P. F. OWENS
Division of Biology & NERC Centre for Population Biology
Imperial College London. Ascot, Berkshire
England (UK)

Cristoph SCHEIDEGGER
Swiss Federal Institute for Forest, Snow and Landscape Research
Switzerland

Mats BJORKLUND
Evolutionary Biology Centre (EBC)
Uppsala University. Uppsala
Sweden

Jan MOTLIK
Institute of Animal Physiology and Genetics
Libechov
Czech Republic

Pierre TABERLET
CNRS UMR 5553, Univ. Joseph Fourier. Grenoble
France

Panel 3.2 (Barcelona)

Jean François MINSTER (Chair)
CNRS. Paris
France

Maurice HÉRAL
IFREMER. Issy-les-Moulineaux
France

Martin SCHOLTEN
Netherlands Institute for Fisheries Research (RIVO)
Ijmuiden
The Netherlands

Phil WEAVER
Southampton Oceanography Centre
Southampton
England (UK)

Victor SMETACEK
Alfred Wegener Institute for Polar and Marine Research
Bremerhaven
Germany

Panel 3.3 (Zaragoza)

Sierd CLOETINGH (Chair)
Hoofd afdeling Tektoniek
Vrije Universiteit. Amsterdam
The Netherlands

Lars STEMMERIK
Geological Survey of Denmark and Greenland
Copenhagen K
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Department of Earth Sciences
University of Cambridge. Cambridge
England (UK)

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Clermont-Ferrand
France

John LUDDEN
Directeur Adjoint
INSU/SDU – CNRS. Paris
France

Jorg OTT
University of Vienna
Marine Biology Department. Vienna
Austria

Panel 3.4 (Seville)

Sue WHITE (Chair)
Institute of Water and Environment
Cranfield University. Silsoe, Beds
England (UK)

Steve ALBON
The Macaulay Institute
Craigiebuckler
Scotland (UK)

Scott ARMBRUSTER
School of Biological Sciences
University of Portsmouth
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EOST-Centre de Géochimie de la Surface
CNRS UMR 7517. Strasbourg Cedex
France

Alessandro MINELLI
Universitá di Padova. Padova
Italy

Daniel ARIZTEGUI
F. A. Forel Institute & Dept. of Geology and Paleontology
University of Geneva. Geneva
Switzerland

Panel 3.5 (Cádiz)

Prof. Dr. Carlo HEIP (Chair)
Centre Director
NIOO-CEME. AC Yerseke
The Netherlands

Anders LINDROTH
Lund University
Department of Physical Geography. Lund
Sweden

Einar SVENDSEN
Institute of Marine Research. Bergen
Norway

Bo RIEMANN
VLIZ: Flanders Marine Institute
National Environmental Research Institute. Roskilde
Denmark

January WEINER
Centrum Doskonalos´ci Unii Europejskiej IBAES. Krakow
Poland

AGRICULTURAL SCIENCES AREA

Panel 4.1 (Torremolinos, Málaga)

John SNAPE (Chair)
John Innes Centre. Norwich
England (UK)

Jean-François BRIAT
Biochimie & Physiologie Moléculaire des Plantes - UMR 5004.
Montpellier
France

Silviero SANSAVINI
Dipartimento di Colture Arboree
Università di Bologna, Bologna
Italy

Luis SANTOS PEREIRA
Universidade Técnica de Lisboa
Instituto Superior de Agronomía. Lisboa
Portugal

Jari P.T. VALKONEN
Professor, Virology
Department of Plant Biology and Forest Genetics
Genetics Centre, Swedish University of Agricultural Sciences (SLU)
Sweden

Dino TORRI
Istituto per la Genesi e l'Ecologia del Suolo. Florence
Italy

Chris MOLLEMA
Wageningen University and Research Centre. Wageningen
The Netherlands

Peter JW LUTMAN
IACR Rothamsted. Harpenden
England (UK)

Rainer Georg JOERGENSEN
Univ. Kassel
Dept. Soil Science and Plant Nutrition. Witzenhausen
Germany

Panel 4.2 (Granada)

Silvio GIANINAZZI (Chair)
Univ. Bourgogne,
Ctr. Microbiol. Sol & Environm. (CMSE). Dijon
France

Eva Mari ARO
Univ. Turku,
Dept. Biol. Plant Physiol. & Mol. Biology. Turku
Finland

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University College Cork (UCC. Cork
Ireland

Mickey G. PALMGREN
Royal Vet. & Agr. Univ.
Dept. Plant Biology. Frederiksberg
Denmark

Ben LUGTENBERG
Leiden Univ.,
Inst. Biology. Leiden
The Netherlands

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Danish Inst. Agr. Sci. Res. Ctr. Foulum,
Denmark

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Tech. Univ. Dresden,
Fac. Forest Geo. & Hydro. Sci.,
Inst. Soil Sci. & Site Ecol. Tharandt
Germany

Marco TREVISAN
Univ. Cattolica Sacro Cuore,
Ist. Chim. Agraria & Ambientale. Piacenza
Italy

PHYSICAL SCIENCES AND TECHNOLOGY AREA

Panel 5.1 (Barcelona)

Jean-Pierre BOURGUIGNON (Chair)
Institut des Hautes Etudes Scientifiques IHES
Bures-sur-Yvette
France

Nigel HITCHIN
Mathematical Institute. Oxford
England (UK)

Tero KILPELÄINEN
University of Jyväskylä
Finland

Panel 5.2 (Madrid)

Jean Paul LAUMOND (Chair)
LAAS-CNRS. Toulouse Cedex 4
France

Giorgio SBERVEGLIERI
Universidad degli Studi Brescia. Brescia
Italy

Professor Bryan WOODWARD
Engineering Research School
Loughborough University. Leicestershire
England (UK)

Panel 5.3 (Madrid)

Jean AUDOUZE (Chair)
Institut d'Astrophysique de Paris
France

Gerhard SCHWEHM
ESTEC, AG Noordwijk
The Netherlands

Peter N. WILKINSON
University of Manchester, Macclesfield. Cheshire
England (UK)

James L. DAVIS
Harvard Smithsonian Center for Astrophysics
Cambridge, Massachusetts 02138
USA

C. Malcolm WALMSLEY
Osservatorio Astrofisico di Arcetri
Istituto Nazionale di Astrofisica. Florence
Italy

Panel 5.4 (Madrid)

Professor Gabriel CREAN
Director National Microelectronics Research Centre
Tyndall Institute
Ireland

Prof. Dr. Volker SAILE
Director
Institute of Micro-structure Technology IMT
Karlsruhe Research Center FZK
Germany

Professor Francis BALESTRA
Director
IMEP Institute of Microelectronics,
Electromagnetism and Photonics
University of Grenoble
France

Panel 5.5 (Granada)

Roberto BATTISTON (Chair)
INFN - Sezione di Perugia. Universitá di Perugia. Perugia
Italy

Muhsin HARAKEH
Kernfysisch Versneller Instituut K.V.I.
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Inst. of Theoretical Particle Physics
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Istituto per i processi chimico-fisici (IPCF)
CNR, Pisa
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Dietrich WEGENER
Fachbereich Physik
Universität Karlsruhe. Dortmund
Germany

Giancarlo RIGHINI
Nello Carrara Institute of Applied Physics, IFAC-CNR. Florence
Italy

MATERIALS SCIENCE AND TECHNOLOGY AREA

Panel 6.1 (Madrid)

Adrian Ernest LONG (Chair)
Queen's University. Belfast
N. Ireland (UK)

Ludwig Julius GAUCKLER
Swiss Federal Institute of Technology. Zurich
Switzerland

Stuart BLACKBURN
University of Birmingham
England (UK)

Hans-Wolf O. REINHARDT
Institut für Werkstoffe im Bauwesen
Universität Stuttgart. Stuttgart
Germany

Peter GREIL
University of Erlangen-Nuernbere. Erlangen
Germany

Yvan Jean U. HOUBAERT
Universiteit Gent, Gent.Zwijnaarde
Belgium

Pierre-Claude AÏTCIN
Université de Sherbrooke. Québec
Canada

Panel 6.2 (Madrid)

Herbert D. GLEITER (Chair)
Institut fuer Nanotechnologie, Karlsruhe Research Center.
Karlsruhe
Germany

Stuart HAMPSHIRE
University of Limerick, Limerick
N. Ireland (UK)

Elio TOSATTI
Scuola Inernazionale Superiore di Studi Avanzati. Trieste
Italy

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Université Claude Bernard Lyon, Villeurbanne
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Orlando AUCIELLO
Argonne National Laboratory. Argonne. IL
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Gisela SCHÜTZ
Maxplank Institute für Metallforschung. Stuttgart
Germany

Hans E. HOENIG
Institut für Physikalische Hochtechnologie e.V., Jena
Germany

Panel 6.3 (Madrid)

Franceso CIARDELLI (Chair)
Universitá Pisa. Pisa
Italy

Piet J. LEMSTRA
Technische Universiteit Eindhoven. Eindhoven
The Netherlands

Jean-François LEGRAND
Institut Charles Sadron, CNRS. Strasbourg
France

FOOD SCIENCE AND TECHNOLOGY AREA

Panel 7.1 (Madrid)

Henrik Jorgen ANDERSEN (Chair)
Danish Institute of Agricultural Sciences. Tjele
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Reinhold CARLE.
Institute of Food Technology
Hohenheim University Stuttgart. Stuttgart
Germany

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Veronique MONNET
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Marcel ROBERFROID
Université Catholique de Louvain
Louvain-La –Neuve
Belgium

Pedro MORADAS FERREIRA
Instituto de Ciencias Biomedicas Abel Salazar
Universidade do Porto. Porto
Portugal

CHEMICAL SCIENCES AND TECHNOLOGY AREA

Panel 8.1 (Madrid)

Pierre VOGEL (Chair)
Ecole polytechnique fédérale de Lausanne
Institut des Sciences et Ingénierie Chimiques. Lausanne
Switzerland

Into LAAKSO
University of Helsinki
Faculty of Pharmacy
Finland

Jean-Louis REYMOND
University of Bern. Bern
Switzerland

Rob M.J. LISKAMP
Utrecht University. Utrecht
tThe Netherlands

Panel 8.2 (Madrid)

Jan-Erling BÄCKVALL (Chair)
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András LIPTÁK
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Panel 8.3 (Madrid)

Matthias W. HAENEL (Chair)
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Rafael KANDIYOTI
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Chalmers University of Technology. Gothenburg
Sweden

Panel 8.4 (Madrid)

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