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**Technology foresight in its science and technology  
policy context in Spain**

[Luis Sanz-Menéndez](#), Cecilia Cabello and Fina Antón

CSIC Institute for Advanced Social Studies, Madrid

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In some countries in Europe, Foresight, as a organised process or collective consultation on plausible future developments, has been recently used as a main framework for science and technology policy co-ordination; although in Spain, even though the government is a central player in the national innovation system (NIS) and in the research and technological development (RTD) activities, neither a highly systematic or formalised use of technology foresight has occurred and remains a marginal aspect or a minor dimension for its national RTD policy planning.

However, this does not indicate that in Spain, foresight has been ignored. On the contrary, foresight and evaluation for Spanish S&T were considered very important for the government action in S&T policy planning in mid-1980s and an administrative locus in government for both activities were institutionalised; but Foresight in Spain had not gained the centrality in S&T policy planning as it appears to have happened in other countries, and had been keep as a tool for producing information (reports) on the future developments at sectoral level.

Under the umbrella of *Prospectiva Tecnológica*, a word that in Spanish has strong proximity with French concept *Prospective*<sup>[1]</sup> associated to planning activities, we can identify many different types of activities carried out in a very discontinues way. Also, the understanding of *Prospectiva* has been much more associated to the idea of producing information on the future trends and tendencies, scientific or technological, than to the idea of developing a systematic process of interaction between innovation actors to help their co-ordination in the context of national innovation systems.

In this pages we will try to describe the first attempts to bring foresight into the policy agenda contextualized within the formulation of the Spanish RTD policy. We will also discuss how the forms foresight taken have been punctual and discontinuous, and how they have not matured into a *process* of considering the future in a systematic manner as a part of a collective action. We will try to elaborate on the variables that could explain why in Spain, Foresight as a tool has not shaped S&T co-ordination policy (in addition to its effects on legitimisation), as in some other countries.

In Spain foresight has remained primarily at the level of information production, as opposed to an interaction process among relevant actors, which we can attribute to some specific conditions of the Spanish policy context. Firstly, the socio-economic conditions, in which the political actors operate, have not enhanced the need to use foresight as main tool in the legitimisation process. The context of S&T policy in Spain has been one characterised by strong growth of R&D funding, in which the definition of RTD priorities through a National R&D Plan has been simultaneous to the increase of "non-prioritised funds"; legitimisation of policy making resulted mainly from the raising R&D funds. Secondly, the RTD activities of

industry have had a low level of performance and were dominated by their own independent RTD agendas; in this context most firms have shown no interest or involvement in S&T policy more than just by getting public funds, and therefore the interaction process among the various actors has not emerged. Finally, foresight when "institutionalised" in a bureaucratic locus, with a formal organisation responsible for its development at the national level, has not been able to influence the main stream S&T policy making process, because it had been isolated at the Ministry of Education & Science and separated from the industrial context, the Ministry of Industry clients, thus limited to a "experimental" Foresight activities.

What remains open is whether Foresight, in its modern form as an organised interaction process, will evolve from the discontinuous foresight studies which have been occurring. However we could expect significant changes in this issue if there also some significant changes in the political environment.

### **a) The context of science and technology policy**

As a starting point, we should mention the fact that in Spain the degree of development of the national innovation system has been inadequate, that is, the technological capabilities of the country –measured by any indicator of RTD input or output- were, and still remain, below the European average, and the links and interactions between research actors had been low.

At the end of the seventies, this situation was known, and the comparison with other European countries created pressure for development of a science and technology system. The OECD<sup>[2]</sup> had reported twice (in 1964 and 1970) on the under-development of the Spanish science system but we had to wait until the first years after democratic consolidation for the significant deficiencies in the areas of science and technology, to be brought into a relevant place in the policy and the decision-making agenda.

In 1982, Spain was a country that did not give relative importance to R&D and, compared to other countries with similar levels of development, dedicated very low amounts of public funds for R&D; the situation at that time was that there were many research centres which were poorly organised and had very little resources, but also there was a very low level of industrial involvement in RTD activities which primarily was importing almost all necessary technology. It was the first socialist government who accepted the challenge of changing the situation through political action and reforms, despite the failure, due to political reasons in attempts made by previous governments. During this period in the eighties, a strong political impulse to science and technology development was thus given by the Government, as indicated by the huge increase in public spending.

In 1986, when Spain became a part of the European Communities, the dominant discourse at European level was the so called the "European Paradox", the recognition of a strong research and science base without the corresponding industrial transfer of this knowledge. The European RTD policy was institutionalised in the Single Act which tried to address the critical problem European competitiveness confronting Japan and the US.

Although actions in Spain shared the European approach –with some local rhetoric like the idea "to put the academic research capabilities to work for the social and economic needs"- in fact government policy, evolved to concentrate its efforts for improving the quality and quantity of its public R&D base. The academic circles were making efforts to increase R&D activity, and in addition to its own interest, recognising the significance this had for economic prosperity. However, private firms were subject to big transformations and the absorption of the impact of joining the EC, therefore they were less conscious of the

relevance of R&D activities.

The political impulse to Science and Technology into the political and decision making agendas culminated in 1986 when the Parliament, passed the Law for the Promotion and General Co-ordination for Scientific Research and Technology Development[3], also known as the Law of Science. With this Law a National R&D Plan was established in order to co-ordinate, plan and promote R&D activities.

Co-ordination had been a key word in Spanish S&T policy making, because in the aims of the reformers two main problems were identified: the need to co-ordinate the directions of the research activities of the main actors (firms, universities, public research centres) and the need to co-ordinated the S&T policy initiatives of the different Spanish public administrations. However the main emphasis of the reform was in the "administrative co-ordination", as OECD (1986)[4] criticised.

The approach taken to confront the needs of co-ordinating the different research activities and strategies of the actors was prioritising some of the research fields and topics, under the umbrella of a National R&D Plan formed by different R&D Programmes (like Information Technologies; Biotechnology; Health; Pharmaceuticals, etc) with a list of research tasks to be developed. Funding incentives to carry on these activities were the main mechanisms for alignment of research actors between themselves and with the government.

The idea behind this form of public action in favour of co-ordination and alignment of the research actors was based on the principle of attracting actors by incentives. In this system, Foresight, in its modern form, did not played a central role in the co-ordination of the national innovation system, because the selection of RTD priorities had been developed by traditional planning techniques and partially broadened to consultative processes of aggregation.

The design national R&D Programs of the First National R&D Plan was parallel to a consultative process with experts, researchers, administrations interested and, with less involvement of firms.

In fact, we see that the National R&D Plan (a four year plan presently in its third edition, 1996-99) actually imitates the basic structure and conception of the European R&D Framework Programmes, in the manner that it brings into the priorities some of the issues and research topics that are of main concern of public decision makers and at the same time, aggregates most of the "demands" of the research actors involved in the consultative and decision making processes. At that time, the Government reported that around half a thousand experts were involved in the process of setting priorities, mainly using the procedure of committees and panels.

The Law that created the National R&D Plan fixed that, one of the main criteria used in the process of defining S&T objectives for the various areas and programmes was the "identification of future technological developments" (see art 4 of the Law). However *no formal procedure* for that "identification of future technological developments" was established and this was left to the criteria and practical arrangements made by policy makers.

In addition, the Inter-ministerial Commission for Science and Technology (CICYT) was created with representatives from the Ministries with a significant role in R&D activities, in which the main players were both the Ministry of Industry & Energy and the Ministry of Education & Science. The Commission's main responsibility was to design, promote, support and steer the development of R&D activities in public research institutions, and

incentivate firms' RTD activities, following the priorities set by the National R&D Plan. In order to support the work of the CICYT, a General Secretariat of the National R&D Plan was created and administratively associated to the Ministry of Education & Science.

Regardless that in theory within the Spanish NIS system there is an institutionalised locus for S&T policy co-ordination -the CICYT-, the fact is, in addition to the co-ordination rhetoric, there was no single science and research policy domain in the country. A main characteristic of the Spanish system is the sectorial fragmentation of both, the R&D activities and the S&T policies. Following the ministerial boundaries –and the type of clients- we could identify for the purposes of this project at least three different systems of financial incentives with R&D policies for public and private actors involved in RTD activities: a general academic one, a general industrial one and one specialised in health research (we do not consider for analysis here the special condition of defence research). Even though there is a differentiation between S&T policy domains, there is overlapping and some co-ordination. Two additional Laws were enacted (the General Law of Health in 1986 and the Industry Law in 1992) with relevant impact on the situation and configuration of the diversity of the Spanish RTD system. Although big attempts were made to establish a single and articulated policy for science, technology and innovation, the initiative clearly did not succeed, and by the end of the eighties, different policy domains and strategies were in action.

By what is described above we see that S&T policy is conditioned by different actions and therefore, the foresight activities in Spain can be characterised within such a S&T policy context as discontinuous and diverse.

## **b) The emergence of foresight exercises (prospective studies) in Spain**

In a country with a strong tradition of interventionism in the economy it would be strange not to find some experiences in the field of future planning. In fact, in the sixties, while elaborating the second and third Socio-economic Development Plans –following the French style of planning- systematic consultation was developed, mainly with socio-economic actors, to define the technological development objectives for national industry[5], a significant number of working parties were set out to carry on the definition activities.

There was also a systemic approach of searching into the future, for planning purposes, at the Centre for Industrial and Technological Development (CDTI), created in 1978 as a result of the "Industrial Development" loan by the World Bank to play the role of the promotion of the technological development of the Spanish industry[6].

But it was during the preparatory work for the draft of the "Law of Science", in 1985 (a time in which Spain was also negotiating to join the EC), and latter on while elaborating and drafting in 1986-87 the First National R&D Plan, 1988-91, when the idea of "*prospectiva tecnológica*" (Technology Foresight) came into the arena of modern Spanish RTD policy, and some sectoral reports were elaborated. However no overall approach to Foresight was taken at the general S&T policy, some sectoral RTD policies as the Agriculture Research Policy (Programa Sectorial de Investigaciones Agrarias) had also a significant consideration of the future into their priority setting.

Even though the rhetoric of the *Prospectiva Tecnológica* had been present, the real implementation had been weak, discontinuous and disperse, always in a report form, of different stands: Foresight with a highly scientific content, developed from either a very institutionalised administrative locus or big research institutions; or Foresight with more focus on the competitiveness of the Spanish industry which involved a deep analysis of critical industrial sectors.

In the regulative development of the Law of Science, a government decree in 1987 defined the "organisational and administrative structure to support the action of the CICYT and its permanent Commission". The CICYT would have two administrative units to support its action: the General Secretariat for the National R&D Plan (SGPN), with the level of Directorate General, and the so called National Agency of Evaluation and Foresight (ANEP) with an organic level of sub-Directorate General. This has been the case for the past ten years, but recent changes in the governmental institutional arrangements have modified this situation. Surprisingly this high level of institutionalisation of foresight in a bureaucratic organisation -ANEP- did not end up in a momentum for Foresight in the Spanish S&T Policy.

Even though the ANEP has the name "agency", in practice it is a regular administrative unit of government, with no independent budget or resources from the Ministry Education & Science, thus causing some confusion in the public perception of its role because it functions as part of the administration. The mission of the ANEP, on one hand, included the organisation of the evaluation process of the research projects to be funded by the national R&D programs, and on the other, the promotion of prospective studies in areas of interest of the Inter-ministerial Commission for Science and Technology. This was a significant indication of when the future component of policy planning becomes relevant and that a degree of institutionalisation was considered to be needed to direct and implement foresight exercises in the definition of priorities for S&T research in the National Plan.

But in practice, the ANEP concentrated its activity, almost in a 100 per cent, in organising the administrative infrastructure to facilitate peer review evaluation of the R&D project proposals at a large scale and with sufficient independence to create creditability in the process of public funding of RTD [7]. On the down side, almost no funds or resources were set to organise or carry out a technology foresight initiative, which by the way, had not even been formally requested by the CICYT.

In the evolution of the R&D policy we can observe that, in practice, the Ministry of Education & Science took over more responsibility over the CICYT, and thus helped to increase the protagonism of the academics in S&T policy definition and implementation as opposed to firms and industry. In fact, the organisational infrastructure created at the ANEP –a database of more than 6,000 experts in scientific areas- was extremely biased to academic and basic researchers with very little presence of engineers or researchers working at firms.

The organisational construction of the ANEP reflected its high capabilities in project evaluation and the ability to assess the scientific quality of a project proposal, taken into account the state of the art scientific development, however it left aside any effort to explore evaluation at a programme level. In addition, foresight remained at the level of producing prospective reports, which however in considering innovation tendencies lack the market view necessary to be integrated with S&T. These aspects have contributed additionally to the difficulty for integrating the activities of this line of work at the ANEP into the main stream decision making process for S&T policies.

This is one of the explanations for the reasons why the ANEP, which was administratively dependent of the Ministry of Education & Science –instead of Industry- had only academic expertise with little industrial involvement, and also why it was an improbable institutional place for promoting and implementing a large scale and strongly formalised Foresight, that by definition needs a strong involvement of users (both industry and policy makers). This institutional arrangement for the Foresight in the Spanish government also contributes to understand why in almost all foresight exercises or "experiments", in Spain since the mid-1980s, we see that the main protagonists have always remained in the academic circles.

What is evident is that unlike other countries, where the industrial actors have played an important role, in Spain this has not been the case.

### c) Prospective exercises or "experiments" in Spain

We could say that most of foresight exercises and studies have been promoted by either the National Scientific Research Centre (CSIC), the General Secretariat of the National R&D Plan or the National Agency of Evaluation and Foresight (ANEP) on behalf of the CICYT. However, there are some interesting exceptions of reports commissioned by Governmental Departments from the economic domain, as the Ministry of Industry and Energy, and the sectorial role of private institutions like Fundesco in the field of information technologies. As a balance just to state that, with a lower involvement of industry in these reports, the tendency of Foresight had been most of the times biased to the scientific or knowledge supply side. Also to mention that no overall Foresight exercise or report had been developed, just specific technology, disciplines or sectorial ones.

In the 1980s, the methodologies were of informal nature, basically reuniting experts and researches in seminars to discuss the future tendencies or creating a panel for analysing and reporting on the scientific and technical trends (see table below) . In some cases a document was not produced, but the purpose was for the CSIC and ANEP to gain insight on what the opinions and the consensus on future trends emerged from the discussion in these seminars. The predominant sectorial nature and the academic focus are the main characteristics of Spanish foresight exercises in the 1980s. The purpose was to help define the priorities of the National R&D Plan or selecting areas to be promote at the CSIC, and thus help the selection process for the allocation of funds and resources. The main effort made in Spanish S&T policy was to increase R&D spending and boost its scientific and technological base. Recognising the importance of innovation for economic success and the adhesion to the European Community were the main triggers for this effort. One exception to this cases was the report "New Technologies, Economy and Society" promoted by the Studies Department of the Office of the Prime Minister, with the purpose of defining the government strategy in this areas. However it remained only as the discourse of the Socialist Electoral Programme for 1986 elections.

SOME FORESIGHT EXERCISES IN SPAIN IN THE 1980s			
YEAR	TITLE	ORGANISOR	METHOD
1985	Tendencies in Chemistry	CAICYT-CSIC	Seminar UIMP
1985	New Technologies, Economy and Society in Spain.	STUDIES DEPARTMENT OFFICE of PRIME MINISTER	Research Project with consultation
1986	The Challenge for the 1990s	FUNDESCO	Meeting FUNDESCO
1986	Prospective Study in Earth Science	CAICYT-CSIC	Seminar UIMP
1987	The Future of Food	FAST-CSIC	Seminar FAST-CSIC
1987	Prospective Study in Animal Science	CAICYT-CSIC	Seminar UIMP
1987	The Future of the Management of Renewable Energy Resources in Spain	FAST-CSIC	Seminar FAST-CSIC
1987	Prospective Study in Physics	ANEP-CSIC	Seminar UIMP
1987	Prospective Study in Oceanography	CAICYT-CSIC	Seminar UIMP
1988	The Scientific Community of Information Technologies	ANEP-CSIC	Seminar UIMP

In the late 1980s and early 1990s, the approach to R&D scientific and technological efforts began to change. The results of Spanish R&D showed its fruit with the increase of

publications in research and technology journals, indicating the increase in activity and quality of R&D in Spain. However, it was evident that S&T transfer to industry and the growth of RTD capabilities in firms was not occurring parallel to this process. Nonetheless, there are indications that only recently that industry is becoming more aware of the need and importance of a good scientific base for innovation. The firms, but especially the collaboration between academics-industry, became more important for the aims of the National R&D Plan, at the same time that the Ministry of Industry launched its own R&D industrial promotion programme (PATI) addressing the RTD needs of industry.

At the level of technology foresight exercises, in addition to the efforts undertaken by the ANEP and the CSIC, the evolution became evident when, in 1990, the Ministry of Economics Affairs & Treasury (*Ministerio de Economía y Hacienda*) through the Institute of Economic Prospective commissioned a study on the "Spanish technological demand in the 90s"[8]. A small Delphi was conducted selecting experts from three main groups: innovative firms whom were aware of their role in the science and technology system, researchers in the field of economy and sociology of technology change, and S&T decision makers from government. There were three rounds undertaken and the time horizon was the next 5 years. Among the conclusions, in general terms there was a high level of agreement among the experts with respect to S&T policy and what the near future may be; in particular, areas such as biotechnology, chemistry, materials, environment and food technology were considered key in terms of efforts in R&D.

Also the Ministry of Industry and Energy, in the context of elaboration of a "White Paper" on the Competitiveness of Industry commissioned 12 studies on market and technological trends at sectorial level. Some of the studies included systematic consultations with academic experts in the field and representatives of the companies. A White Paper of Industry[9] was approved by the Spanish Government and it defined, mostly with a methodology base in Porter (weakness, challenges, strength and opportunities.), sectoral prospects and trends at big sectoral level (Aerospace; Shipbuilding; Chemistry and Pharmaceuticals; Food Industries, etc.)

Thus, the foresight exercises conducted during the 1990s changed from the previous decade and used more formal and quantitative methodologies, such as Delphi, scenarios, expert panels, trend analysis and bibliometric studies. The areas of interest changed and were more broader, that is, not just scientific or technological areas were included, but also the socio-economical aspects and implications of the use of new technologies. Some of examples include[10]:

- "Technology Evolution for Multimedia Advanced Services" (1995): the purpose was to identify and analyse the technological environments and scenarios for these technologies for the year 2000, it included a small Delphi study.
- "Optics prospective: Bibliometric analysis for the period 1989-1995" (1996): the purpose was to analyse both private and public research conducted in this field, it also involved an international comparison to position Spain.
- "Future trends in Spanish Society (1997): the main objectives were to determine the macro-tendencies and future expectations for Spanish society. Socio-economic, socio-cultural and socio-political trends were analysed to determine how citizens perceive changes in various technological areas and what concerns they have for the future.
- Delphi study on Scientific-Technological Trends in Spain (1997): the objectives were to determine the main trends for technological innovation in the areas of information

and communication technologies, bio-genetics and robotics. Three rounds were undertaken with a 10 year time horizon.

We also observe that industry had become more involved in this new generation of foresight exercises, mainly through activities that are organised by private foundations (like was the case of FUNDESCO in the field of telecommunications and information technologies and presently the Fundación COTEC in the broad domain of innovation issues).

Nevertheless, in general, the emphasis in the Spanish experience has been related more to foresight that was geared towards R&D policy, as opposed to technology foresight which serves the areas of innovation and technology policy.

#### **d) The present situation in Spain**

The situation in Spain is slowly changing, and there are indications that the general belief is that a closed academic analysis for the vision of the future is not sufficient. There must be an association to policy and decision making, as well as the participation of society and the economic actors in this process.

ANEP, now integrated into the Ministry of Education & Culture, continues its intents to promote foresight and prospective studies within Spain. Presently it organises regular "prospective" seminars, which attempts to raise the consciousness of the importance of foresight among the various actors, and also functions as the main documentation centre in science and technology foresight. In addition, recently it has developed a proposal for a full scale Foresight Program at National level, however, this is something created and promoted internally by those in the ANEP without any formal request from government. This proposal is presently at a halt and there is no immediate plan to begin or take any action. The question remains on whether Spain really needs this type of General Program, and in which policy making context.

On the other hand, since the new conservative government took office in 1996, the Ministry of Industry & Energy is developing a project to determine the future technological demands for Spanish firms in collaboration with firms and business associations, which is linked to the planning activities of the new RTD Industrial Support Programme (ATYCA) . Along these lines, it is organising a network among specialised industrial and technological centres which support specific R&D needs for firms, the *Observatorio de Prospectiva Tecnológica*, in order to monitor and foresee technological trends and help the Ministry of Industry in its definition of RTD priorities.

There are also some regional level initiatives in addition to the central government ones mentioned above, which include a Foresight Programme in the Basque Country (northern region of Spain), and Strategic Technology Plans (RIS-RITTS), where probably these initiatives are seriously associated to policy making, and involve a very broad "consultation" process with stakeholders in the regions.

Finally, it must be pointed out that at the beginning of 1998, new organisational changes in the Spanish S&T institutional framework have been made. The CICYT has been restructured and is now chaired by the Prime Minister. The General Secretariat, as administrative support to the CICYT, has disappeared. The management of the National R&D Plan has been transferred to the Ministry of Education & Culture. Presently, directly under the Prime Minister's office is the newly created Office of Science and Technology (OCYT) which will be in charge of co-ordinating STD policies, conducting studies and analysing the Spanish S&T capabilities. Included within the definition of the legal

competencies of the OCYT, is the responsibility for the "implementation and development of technology foresight in Spain" in co-ordination with other ministries. Therefore, this opens the door to changes in relation to the possible future for foresight initiatives in Spain.

### **e) Lessons learned from the Spanish case**

The final question is why foresight being highly institutionalised in a bureaucratic locus remained outside the S&T policy planning? Trying to understand why in Spain foresight used has not been conducted in the highly formalised –that is with links with policy makers and industrialist- manner as in other countries, we see that this may have two explanations. On one hand, although foresight (and evaluation) were recognised as relevant mechanisms for policy planning (specifically by the creation of the ANEP), the lack of industrial involvement may have handicapped setting up technology Foresight. If foresight were to take on a more high level role in policy planning it would be essential for industry to value the importance of these types of exercises and become more involved. What actually has happened was that the ANEP remained too closely tied to the academic circles, which was needed for good performance of their peer review evaluations, but they were missing the link to industry. . Therefore, foresight, in general, has been taken on at a low level, sectorial nature, using less formal methodologies for the purpose of defining what direction R&D should take and the ANEP remained separate from the main stream RTD decision making process and strategy development.

However, what has occurred could be due to more the failure of the Inter-ministerial Commission of S&T to function as an "inter-ministerial" organisation, rather than the government's recognition of the value and importance of foresight exercises. Nevertheless efforts were made by the ANEP that merit considering despite the structural problems they were confronting. The ANEP found that there was a disconnection between those who finance the prospective studies and the possible clients, which made it difficult to adequately diffuse or even discuss the work that had been achieved,. Other problems for the ANEP relate to the resources available, human and financial, as well as the resources they needed to obtain information, their is a lack of co-ordination or systemised data collection between the sources at national and regional levels.

On the other hand, the second reasoning has a less simpler explanation. It has to do more with the relationship between S&T and government. This refers to the S&T environment where foresight process is to take place. The question we pose is why should rational policy makers become involved in Foresight processes as central frameworks for S&T prioritisation if the tools in use allow them to promote co-ordination through incentives and to align actors with direct financial subsidies and interventions. We suggest that foresight emerges in a policy context in which policy makers react to the process of loosing ground in science and technology. If our expectations were right, we should expect much more propensity to foresight when government officials loose influence, that is, there is reduction of the role of government, which we witness as we move towards the globalisation of the economy and especially to a privatisation process.

Science and technology public policy, has been traditionally been very interventionist, where government presence in S&T is achieved through the allocation of funds, public procurement, actual implementation of S&T through public R&D, and most importantly by setting priorities, and steering public and private R&D. The government functions also as the main client for S&T, especially in high technology sector. In Europe, until recently, this has given the governments a very important role in the economy.

However, nowadays, the tendency is to diminish the role of government through the process of liberalisation and privatisation. Here we see the role of government loosing

importance and thus its need to find new mechanism to control R&D especially in critical high technology areas. In a general context, we see that foresight emerges during in a period where the process of liberalisation and privatisation has been diminishing the role of the government as key actor in the economy. In the context of science and technology research, in general governments have always had a high level of intervention: implementation of S&T research organisations, the allocation of funds, and co-ordination and definition of priorities. With these trends in privatisation of public firms and liberalisation of the markets, S&T research has been directly affected.

Government and policy-makers may be responding to this decrease in importance with mechanisms, such as formalised foresight exercises of consultation and interaction in order to provide them with the necessary instruments for incentives and influence over the private actors and innovation process. Along these lines, funding is becoming restrictive, there is a need to select priorities, as well as the social forces that demand accountability and legitimisation of public funding. Foresight may be responding to these pressures by contributing to the legitimisation process and election of R&D priorities.

In Spain, until very recently the main industrial players in RTD development were public companies or governmental customers; in fact in mid-eighties the Government action to promote technological development and catching up future technological development was mainly organised directly through the big public industrial and services companies, for example the national telephone company Telefónica. Today, however, Spain is in this process of privatisation and liberalisation which is rapidly advancing. This may suggest that, in addition to the restraints that "competition policy" introduces in the financial incentives for RTD promotion, in the near future government may see advantageous the use formalised foresight as a framework for their policy co-ordination and for co-ordination of innovation actors in the national innovation system, through interaction and information dissemination.

## Notes

<sup>1</sup> See for example, M. Godet (1985): *Propective et planification strategique*. Paris: Economica. ▲

<sup>2</sup> OECD (1964): *Country Report on the Organisation of Scientific research: Spain*. Paris: OECD; OECD (1971): *Políticas nacionales de la Ciencia: España*. Madrid: MEC. ▲

<sup>3</sup> For a full description and analysis of the reforms in Science and Technology Policy in Spain, see: Luis Sanz-Menéndez (1997): *Estado, ciencia y tecnología en España: 1939-1997*. Madrid: Alianza Universidad, 428 pp. ▲

<sup>4</sup> OECD (1986): *Innovation policy: Spain*. Paris: OECD. ▲

<sup>5</sup> See for example, Presidencia del Gobierno-Comisaría del Plan de Desarrollo Económico y Social (1972): *III Plan de Desarrollo Económico y Social. Ponencia de Investigación Científica y Desarrollo Tecnológico*. Madrid: Imprenta del BOE, 241 pp. ▲

<sup>6</sup> See for example the so called MODELTEC project: Pavon, J. & Goodman, R.A. (1982): *La planificación del desarrollo tecnológico: el caso español*. Madrid: CDTI, 376 pp. ▲

<sup>7</sup> See L. Sanz-Menendez (1995): "Research actors and the state: research evaluation and evaluation of science and technology policies in Spain", *Research Evaluation* vol. 5, nº 1 (April), pp. 79-88. ▲

<sup>8</sup> Sanchez, P. (1992): *La demanda tecnológica en España en la década de los 90*. Madrid: Ministerio de Economía y Hacienda, 288 pp. ▲

<sup>9</sup> Ministerio de Industria y Energia (1995): *Libro Blanco de la Industria: una política Industrial para España*. Madrid: MINER. ▲

<sup>10</sup> Cabrera, J.A.; Castañer, L.; Jiménez, F.; Presmanes, B.; Vázquez, L. (n.d.): *S&T Foresight Exercises in Spain*. Madrid: ANEP, manuscript (approx. 1996). ▲

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