# Specialized information on R+D in Catalonia

## Llorenç Arguimbau

Catalan Studies Institute - *Observatori de la Recerca Catalana*.
E-mail: llarguimbau@iec.cat
Universidad Autónoma de Barcelona. Documentation area.
E-mail: llorenc.arguimbau@uab.cat

**Keywords**

Research, Development, Innovation, Knowledge, Documentation, Sciencemetrics, Catalonia

**Abstract**

In the present it is very important to describe, measure, analyze and evaluate a R+D+I system. To use quality information is an essential element for the right management and evaluation of the scientific and technological breakthroughs. Unfortunately, this task of study and appraisal shows numerous difficulties. Besides from directly helping the scientific and technical activity with libraries and specialized information services, the documentalists can collaborate arranging, unifying, analyzing, retrieving and spreading the R+D+I data.

## 1. Introduction

This article reviews the essential points of a research paper presented in July 2006 at the Autonomous University of Barcelona (*Universitat Autónoma de Barcelona*) in compliance with the requirements of the "Documentation and Information in the digital era" PhD.

Research and development (R & D) are two scientific and technological activities involving the creation of new knowledge, key for the overall progress of society. The investigation agents move financial, human and material resources (input) for the purpose of obtaining results (outputs): scientific articles, dissertations, patents, etc. These outputs increase the quantity and quality of knowledge about the reality and facilitate socio-economic progress. The cycle ends with the practical use of the progress achieved through innovation, the third branch of applied industrial progress: creating new processes and products.

It is clear that there is a need to describe, measure, analyze and evaluate a system of R & D in order to determine its position in a extremely competitive international arena, enhance its efficiency, identify strengths and weaknesses, and so on. Unfortunately, this task of study and assessment of a structure of R & D is far from easy. In this sense, the research here presented intended to defend the following thesis: In addition to supporting scientific and technical activity through libraries and documentation centers, we must make the documentalists work and collaborate to consolidate, unify, analyze, retrieve and disseminate datum on R+D in an efficient, fast and accurate way. Using quality information is essential for the management and evaluation of scientific and technological achievements and for the decision making process on science policy.

In order of importance, the main objectives of this research work were:

- Describing the current state of the information specialized on R & D activities in Catalonia and the institutions that are more closely involved.
- Compile existing data sources (databases, directories, reports, etc.).
- Review the theoretical primary thesis of the study of a system, trying to apply the criteria used on documentary science.
- Examine the scientific and technological documentary production, establishing relations with the global cycle of R+D+i.

This research wanted to give an initial overview and description of the main institutions, systems and information sources that are responsible for identifying, analyzing and disseminating data on R & D in Catalonia. Both the institutions involved (universities, government, research institutes, etc.) as well as the information resources (databases, directories, reports, websites, etc.) belong to quite different typologies (see Bibliography and Annex).

Regarding the method of work used in the research, once the available material was studied, a questionnaire was done to be sent to the technicians and agents of the management, study and information services on R & D, all in order to know what they had to say on the matter. The choice of field work came from the lack of specific analysis done on the subject. The investigation concluded with the compilation of the essential sources of information, putting emphasis on the e-documents that are regularly updated.

Regarding the structure of work, once the objectives and methodology were presented, we tried to set the theoretical framework of the analyzed material. Based on input from the OECD (mostly from the Frascati Manual, see Bibliography) the main concepts (R & D, system, etc..) classifications (institutional or functional) and indicators (selected from some of the periodic

surveys on the most important activities of R & D) are defined. The basic categories of indicators are:

- Economic, human and material resources (input).
- Results (outputs): science and technology magazines (articles, patents, etc.) and economic data (innovation, technological scale, etc.).

The research work also addresses the issue of scientific and technological documentation. Firstly, we review the basic types, characteristics and production cycle. Secondly, we identify ways to examine these documents, reviewing the ideas of Callon, Courtial and Penan on scientometrics (see Bibliography). The research must be scientifically studied in order for us to boost it, applying strictly the scientific method, without forgetting the contributions of the metric studies of information and documentation. In addition, we explore the most significant journal articles, patents, theses, conferences and contributions to literature.

The next section of the research presents a more practical character applied to the structure of R & D in Catalonia. On the one hand, the sectors that include the executers of the research are described (government, enterprises, universities, etc.). On the other hand, the policy regarding science is also studied from the perspective of government agencies and of the organizations responsible for driving force, funding, coordination, support and advice on the system.
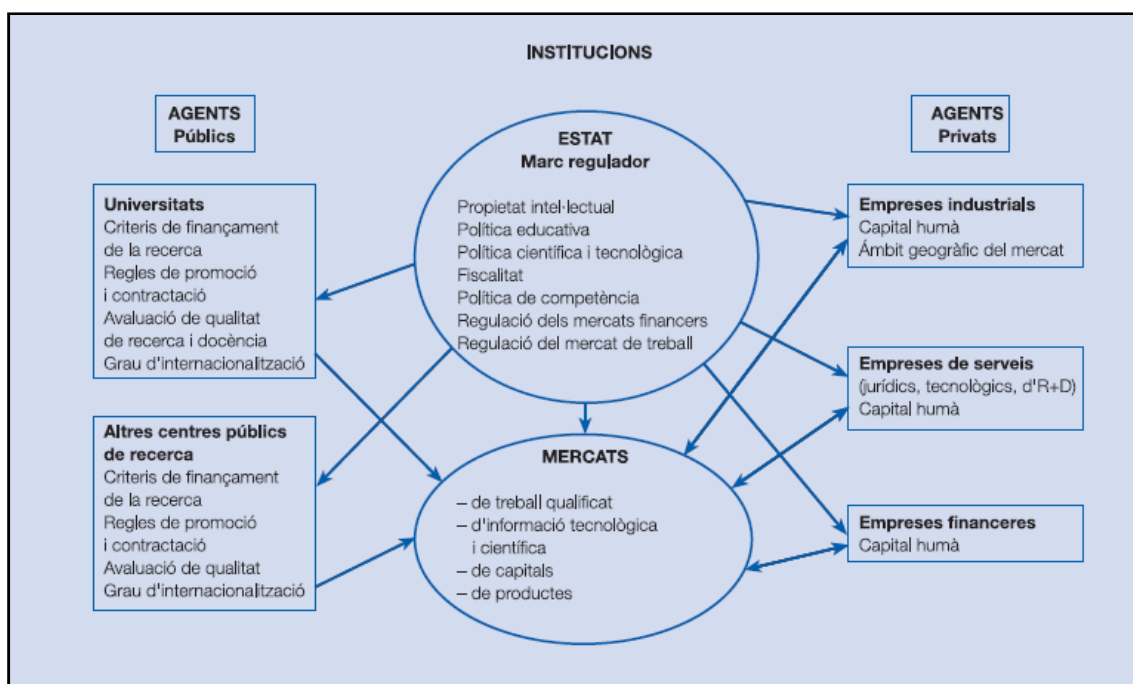


**Figure 1:** R+D+I system
Source: Busom (2004)

## 2. Cycle of information on R & D

The core of this investigation includes the information obtained in several interviews conducted during 2005 done to heads and technicians of services and units specialized in management, study and information on R & D. The questionnaire attempted to review the cycle of information generated by scientific and technical research. The people interviewed had to answer to questions about the institutional context (structure, human resources and IT, etc.),

about specialized information on R & D, specifically about information sources, about processing (analysis systems, thematic areas, time ranges, etc..) and about output data (preparation of reports, databases, etc.). All along the process, we tried to show the most pluralistic view of the subject, with various agencies with different legal status (public or private), purpose (financing or executing), industry, size, etc. The following services, units and the relations that exist between them were analyzed:

- Public Administration
- Coordination of Information Systems (CSI) of the Catalan Department of Universities, Research and Information Society (DURSI).
- Agency for the management of university and research grants (AGAUR).
- Center for Innovation and Enterprise Development (CIDEM).
- Universities
- Office of Management Research (OGR), University of Barcelona (UB).
- Bureau of Studies and Information Management (OEGI) from the Autonomous University of Barcelona (UAB).
- Area of Research and Development of the UAB.
- Area of Research of the University of Catalonia (UPC).
- Unit of studies, planning and evaluation (UEPA), University Pompeu Fabra (UPF).
- Management of Research and Technology Transfer of the Vice-Chancellor for Research and Technology of the Ramon Llull University (URL).
- Research Institute
- Area of Communication of the Biomedical Research Institute August Pi i Sunyer (IDIBAPS).
- Institute of Research and Technology of Food (IRTA).

Regarding the corporate government of the institutions involved, the information collected shows a very heterogeneous and unstable situation. In the field of higher education there is a lack of accurate data on the status of the centers (affiliated, in consortium, mixed, etc.) Regarding the human teams of the studied units, there is little presence of documentary professionals, and furthermore, the daily tasks of managing the R+D activities is much more important than the careful treatment of the information. It has also been observed, thanks to the IT resources available, that identifying and examining the R+D actions with quantitative and qualitative information is possible. The IT resources also give documentary support for the dissemination of outputs and the management of the curriculum vitae (CV) of the researchers.

When studying the sources of information, we observed that in the agencies that manage the public grants providers are also the applicants. Meanwhile, the government is fed by data from the agencies that depend hierarchically from that same government. In universities, information about inputs comes from internal databases of personnel and databases about financial management but the outputs are the responsibility of the researchers, who have not, until now, the obligation to introduce or update their CV in research deposits. This whole situation creates a lack of robustness and completeness of the information, and makes it compulsory to monitor and validate all the data of the results. Therefore, most institutions consult the ISI Thomson scientific databases to measure scientific outputs created in the system. Finally, the two analyzed institutes require formal storing of their result records.

With regard to the processing, we must bear in mind that if the information is sufficiently proven, besides from describing and measuring the R & D activities, in some cases it is also possible to provide evaluation and assessment. The most common classifications are the thematic areas of the Spanish Ministry of Education and Science (MEC), the UNESCO codes, the fields of the scientific and technical assessment council (CONACIT), etc. Furthermore, the use of keywords and abstracts is more and more common. There are taxonomies specially

adapted to the needs of some institutions, which makes it difficult to compare content of different institutions.

Finally, the results of the cycle of information on R & D are: institutional memory, databases (public or restricted), reports (newspapers, sectoral, punctual, etc.), Sending data in response to formal requests, internal tools for management and administration, and so on.

## 3. Conclusions and proposals for future

The importance of R & D is evident. The establishment and incorporation of knowledge in the socio-economic structure of a country represents a decisive advantage in a competitive environment. It is essential to have robust, relevant and comparable information to make good decisions for the progress of science and technology. From a documentary pint of view, there are few studies on the global cycle of specialized information on R+D+i and we must make a direct analysis of the services and specialized units. As a result of this approach, one can describe the current situation and potential problems are detected.

The analysis of the specialized services shows a positive overall trend in the treatment of information on R & D. This assertion is demonstrated by the establishment of specific units that act as filters agglutinated with information. Generally speaking, the data managed by these units is considered useful and reliable, particularly regarding the input, and we must improve the internal sources of information on outputs. However, some people interviewed think that the current situation is optimal, that they have enough information and that the quality is guaranteed. In any case, we must continue to cooperate with initiatives like the investigation glossary of the DURSI, the Scientific Documentation Program of the AGAUR or RECERCAT (Consortium of Academic Libraries of Catalonia, CBUC).

As you can see, the description, study and assessment of a system of R & D is not easy. The data must reflect the entire cycle, without being restricted to certain resources or results. In the documentary area, most studies focus on bibliometric information derived from scientific articles. We need a quantitative and qualitative analysis of research from a panoramic perspective, with particular attention to the balance of all components of the system. A structure of R & D consists of a huge number of actors both performers and funders, which involves a great fragmentation of data. Furthermore, the constant research makes it hard to determine the object of analysis, because new areas of study, concepts, techniques, interdisciplinary spaces and collaborative spaces are emerging all the time. Therefore it is essential to define in a unique way the concepts that are involved and work with standardized classifications and methodologies. It is very important to emphasize that the information must be able to be compared from different levels (geographical, institutional, thematic, etc.) all in order to set a both internal and external reference framework that can be used in any other study.

One possible way forward is to analyze accurately and thoroughly the different types of documents and their dynamics in each field of scientific and technological knowledge, overcoming the disadvantages described and providing robust methodologies. Rather than quantitative, qualitative studies are needed with a high added value on issues relevant for the scientific research like for example the international resonance, the interdisciplinary collaboration, detection of networks, etc. We need to develop new indicators created from

queries done to electronic serial journals, patents, bibliometric studies applied to the humanities and social sciences, and so on. We must also deepen into the mechanisms of technology transfer between universities and companies.

From a multidisciplinary perspective, the study reviewed in this article tries to demonstrate in an embryonic way how documentary science can help the economy, the statistics, sociology and philosophy of science to solve the difficulties and problems detected. As in any other field of information, documentalists can efficiently, quickly and accurately organize the flow of inputs, outputs and processing of data. We must recognize the importance of documentalists, which may prove critical in designing and implementing unambiguous taxonomies or classifications or when it comes to enhance scientific and technological initiatives. By doing it, they are boosting the overall progress of collective knowledge. Effective internal management of information in the R & D agents can create a virtuous cycle, increasing the generation of results and thus, access to more resources.

**Bibliography**

BELLAVISTA, JOAN [et al.] (1997). *Evaluación de la investigación*. Madrid: Centro de Investigaciones Sociológicas.

BUSOM, ISABEL (2004). *"Recerca, Desenvolupament i Innovació (R+D+I): una perspectiva sobre la situació de Catalunya i Espanya"*. *Coneixement i Societat*, Núm. 5 (2n quarter), p. 6-35.

CALLON, MICHEL; COURTIAL, JEAN-PIERRE; PENAN, HERVÉ (1993). *Cienciometría: la medición de la actividad científica: de la bibliometría a la vigilancia tecnológica*. Gijón: Trea.

CONSELL INTERDEPARTAMENTAL DE RECERCA I INNOVACIÓ TECNOLÒGICA, CIRIT (2005). *Pla de Recerca i Innovació 2005-2008*. Barcelona: CIRIT.

CONFEDERACIÓN DE SOCIEDADES CIENTÍFICAS DE ESPAÑA, COSCE (2005). *Acción CRECE: comisiones de reflexión y estudio de la ciencia en España*. Madrid: COSCE.

EUROPEAN COMMISSION (2005). *Key Figures 2005: towards a European Research Area: Science, Technology and Innovation.* [Brussels.]: European Commission. Directorate-General for Research.

FUNDACIÓN ESPAÑOLA PARA LA CIENCIA Y LA TECNOLOGÍA, FECYT (2005). *Indicadores bibliométricos de la actividad científica española 2004*. Madrid: FECYT.

GÓMEZ CARIDAD, Isabel [et al.] (2004). *Proyecto de obtención de indicadores de producción científica y tecnológica de España* [available online]. Madrid: CINDOC. <http://www.cindoc.csic.es/investigacion/informe1.pdf>. [Consulted: 10.02.2007].

GORBEA PORTAL, SALVADOR (2005). *Modelo teórico para el estudio métrico de la información documental*. Gijón: Trea.

LANCASTER, WILFRID; PINTO, MARÍA (coord.) (2001). *Procesamiento de la información científica*. Madrid: Arco/Libros.

MALTRÁS, BRUNO (2003). *Los indicadores bibliométricos: fundamentos y aplicación al análisis de la ciencia*. Gijón: Trea.

MALUQUER DE MOTES I BERNET, JORDI (2004). *La recerca i innovació a Catalunya l'any 2001*. Barcelona: DURSI.

MEC (2005). *Indicadores del sistema español de ciencia y tecnología 2005* [available online]. <http://www.mec.es/mecd/estadisticas/ciencia/indicadores/Indicadores_2005.pdf>. [Consulted: 02.03.2007].

OCDE (2003). *Manual de Frascati 2002: propuesta de norma práctica para encuestas de investigación y desarrollo experimental*. Paris: OCDE: FECYT.

OCDE (2005). *Main Science and Technology (MSTI)*. París: OCDE.

**Resources available online**

6º Programa Marco. <Http://cordis.europa.eu/fp6>

7º Programa Marco. <Http://www.cordis.lu/fp7>

Activities of the European Union - Research and Innovation. <Http://europa.eu.int/pol/rd/index_en.htm>

Agencia Catalana de Ayudas Universitarias y de Investigación. <Http://www.gencat.cat/agaur>

Agencia Nacional de Evaluación de la Calidad y Acreditación. <Http://www.aneca.es>

Agencia Nacional de Evaluación y Prospectiva. <Http://www.mec.es/ciencia/anep>.

Agencia para la Calidad del Sistema Universitario de Cataluña. <Http://www.aqucatalunya.org>

Base de datos FENIX de producción científica UPC. <Http://bibliotecnica.upc.edu/fenixdoc/>

Base de datos web UAB. <Http://recerca.uab.es/caw/>

Centro de Patentes UB. < http://www.pcb.ub.es/centredepatents/>

Centro de Innovación y Desarrollo Empresarial. <Http://www.cidem.com>

Centro de Información y Documentación Científica. <Http://www.cindoc.csic.es>

Centro para el Desarrollo Tecnológico Industrial. <Http://www.cdti.es>

Comisión Nacional Evaluadora de la Actividad Investigadora. <Http://www.mec.es/ciencia/cneai>

Confederación de Rectores de las Universidades Españolas. <Http://www.crue.org>

Confederación de Sociedades Científicas de España. <Http://www.cosce.org>

Consejo Interdepartamental de Investigación e Innovación Tecnológica. <Http://www10.gencat.net/dursi/ca/de/cirit.htm>

Datos estadísticos y de gestión de la UPC. <Http://www.upc.edu/dades/>

Departamento de Innovación, Universidades y Empresa. <Http://www.gencat.cat/diue>

EUREKA: En Network for Market-Oriented Industrial R&D and Innovation. <Http://www.eureka.be>

European Patent Office. <Http://www.european-patent-office.org>

European Research Area. <Http://ec.europa.eu/research/era/index_en.html>

European Science Foundation. <Http://www.esf.org>

Euroscience. <Http://www.euroscience.org>

Fundación Catalana para la Investigación y la Innovación. <Http://www.fcri.es>

Fundación COTECA para la Innovación Tecnológica. <Http://www.cotec.es>

Fundación Española para la Ciencia y la Tecnología. <Http://www.fecyt.es>

GRIEGO UB. <Https://webgrec.ub.edu>

Grupo de Investigación en Bibliometría y Evaluación en Ciencia. <Http://www.prbb.org/bac>

Institución Catalana de Investigación y Estudios Avanzados. <Http://www.icrea.es>

Instituto de Estadística de Cataluña. <Http://www.idescat.net>

Instituto Nacional de Estadística. <Http://www.ine.es>

Institute for Statistics. <Http://www.uis.unesco.org>

Japan Patent Office. <Http://www.jpo.go.jp>

Joint Research Centre. <Http://www.jrc.cec.eu.int>

Ministerio de Educación y Ciencia. <Http://wwwn.mec.es>

Ministerio de Industria, Turismo y Comercio. <Http://www.mityc.es>

Observatorio de la Investigación Catalana. <Http://www.iec.cat/orc>

Observatorio de Prospectiva Tecnológica Industrial. <Http://www.opti.org>

Oficina Española de Patentes y Marcas. <Http://www.oepm.es>

Organización Mundial de la Propiedad Intelectual. <Http://www.wipo.int>

Organización para la Cooperación y Desarrollo Económico. <Http://www.ocde.org/>

Plan de Investigación e Innovación. <Http://www.gencat.net/pricatalunya>

Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica. <Http://wwwn.mec.es/ciencia/plan_idi>

Plataforma de Integración de Estudios métricos y Estadísticos de información. <Http://bidoc.ub.es/pub/emei/recerca.htm>

RERCERCAT. <Http://www.recercat.net>

Red de Bibliotecas Universitarias Españolas. <Http://rebiun.crue.org>

Red de Indicadores de Ciencia y Tecnología Iberoamericana e Interamericana. <Http://www.ricyt.edu.ar>

RedIRIS: Red española de I+D. <Http://www.rediris.es>

RedOTRI universidades. <Http://www.redotriuniversidades.net>

Research Community Research and Development Information Service. <Http://www.cordis.lu>

Revistas Catalanas con Acceso Abierto. <Http://www.raco.cat>

SCImago Research Group. <Http://www.scimago.es>

Tecnobusca. <Http://www6.gencat.net/cidem/tecnocerca/index.asp>

TESEO. <Http://www.mcu.es/TESEO/>

Tesis Doctorales en Red. <Http://www.tdx.cbuc.es>

Unidades de i+D en Cataluña. <Http://www10.gencat.net/dursi/ca/re/directori_r_d.htm>

United States Patent and Trademark Office. <Http://www.uspto.gov>

Red de Parques Científicos y Tecnológicos de Cataluña. <Http://www.xpcat.net>