

The MERIDIÀ web portal: the study and dissemination of Catalan science

Llorenç Arguimbau,^{1,2} Aldara Cervera,² Mercè Martí,² Robert Latorre³

1. Information Science Area, Department of Catalan Philology, Autonomous University of Barcelona, Bellaterra, Spain

2. Observatory for Research, Institute for Catalan Studies, Barcelona, Spain

3. Computer Department, Institute for Catalan Studies, Barcelona, Spain

Resum. El cicle de la recerca, el desenvolupament i la innovació (R+D+I) ocupa una posició estratègica perquè potencia el coneixement científic i el creixement econòmic. Per al bon funcionament d'aquest cicle, és imprescindible realitzar una gestió eficaç de la informació. En els darrers anys, l'Institut d'Estudis Catalans (IEC) ha desenvolupat un paper creixent com a entitat consultora dels agents públics, mitjançant l'elaboració d'informes i dictàmens sobre aspectes estratègics de la política científica catalana. L'any 1995, l'IEC engegà el projecte *Reports de la recerca a Catalunya*, consistent en l'elaboració d'un estudi, per matèries específiques, sobre l'estat de la recerca al Principat. L'any 2003, per donar suport a les tasques d'elaboració de la segona edició, es va posar en funcionament l'Observatori de la Recerca de l'Institut d'Estudis Catalans (OR-IEC). Des de llavors, l'OR-IEC ha anat incorporant dades sobre el sistema R+D+I de tots els territoris de llengua i cultura catalanes. El 2008 s'ha posat en marxa el portal web *Meridià*, que és un servei pensat com una eina útil i pràctica per a diferents tipus d'usuaris, des dels investigadors fins als ciutadans interessats. *Meridià* pretén, essencialment, ser una eina per a transformar, en coneixement, una gran quantitat de dades disperses i heterogènies sobre les activitats de R+D+I catalanes.

Paraules clau: R+D+I · recerca · desenvolupament · innovació · documentació · observatori · portal MERIDIÀ · documentació científica

Summary. The highly strategic research, development, and innovation (R&D&I) cycle is fundamental to scientific knowledge and economic growth. For the cycle to function adequately, relevant R&D&I information has to be managed effectively. In recent years, the Institute for Catalan Studies (IEC) has played an increasingly important role as a consultant to public bodies, primarily by preparing reports and expert opinions on strategic aspects of Catalan science policy. In 1995, the IEC started the *Reports de la recerca a Catalunya* (Catalan Research Reports) project, describing the state of Catalan research in specific knowledge fields. In 2003, in order to support the work involved in producing the second edition of the *Reports*, the IEC founded the Observatori de la Recerca (Observatory for Research, OR-IEC). Since then, the OR-IEC has gradually compiled data on the R&D&I system from all the Catalan linguistic-cultural regions. In 2008, the web portal MERIDIÀ (Measurement of Research, Development and Innovation) was launched with the aim of serving as a useful and practical tool for a broad spectrum of users, ranging from researchers to interested members of the general public. MERIDIÀ provides a tool for transforming the large quantity of dispersed and highly heterogeneous information on R&D&I activities in Catalonia into accessible knowledge.

Keywords: R&D&I · research · development · innovation · information science · observatory · MERIDIÀ portal · scientific documentation

Introduction

Research and development (R&D) are two scientific and technological activities that lead to the creation of new knowledge, crucial to the advancement of society. Researchers mobilize economic, human, and material resources as inputs, with a view to obtaining results, or outputs, in the form of research articles, doctoral dissertations, patents, etc. The cycle con-

cludes with innovation as a third element in what is referred to as an R&D&I system (with innovation defined as the practical industrial application of results that leads to the development of new processes and products).

In today's information society, the cycle of R&D&I occupies a strategic position, as these components promote scientific knowledge and economic growth in a markedly dynamic international environment. It is therefore fundamental to describe, measure, analyze, and evaluate R&D&I systems in order to gauge achievements and improve functioning. This will ultimately enhance the efficiency of the system and ensure that the appropriate scientific-policy decisions are taken [4].

Any R&D&I system is, in fact, composed of an enormous number of producing and funding agents, which implies the potential fragmentation of information [6]. The description, study, and evaluation of a system is a complex task in light of the range of methodologies, classifications and indicators, the variety and differences in sources of information, difficulties in accessing data, fuzzy boundaries between scientific areas, etc. Furthermore, R&D needs to be distinguished clearly from a large number of often similar activities, such as teaching and training, information and data compilation, feasibility studies, testing and the creation of standards, applications for patents and licences, etc. On the other hand, ongoing research to expand human knowledge renders it difficult to set precise aims for analysis, as new study areas, concepts, techniques, interdisciplinary possibilities, etc., are constantly arising.

Compiled information needs to reflect the complete R&D&I cycle and not just specific resources or results. It is often necessary to make a quantitative and qualitative analysis of research from a panoramic perspective. Furthermore, it is important to clearly define the underlying concepts and to use standardized classifications and methodologies. Information has to be comparable at different levels (geographic, institutional, thematic, etc.) in order to allow a suitable reference framework for studies to be established. As in any other information sphere, the dynamics of data inflows, processing, and outflows have to be organized in an efficient, responsive, and accurate manner. A key role is played by documentalists in fostering and communicating information on science and technology initiatives and their outcomes.

The Observatory for Research of the Institute for Catalan Studies (OR-IEC)

In 1995, the Permanent Council of the IEC agreed to launch a project entitled *Reports de la recerca a Catalunya* (Catalan research reports), aimed at publishing studies on the state of research in Catalonia that would apply internationally recognized criteria. Commissioned by the Autonomous Government of Catalonia and coordinated by the Scientific Secretariat of the IEC, these reports were structured as a regular series of studies of each of the areas into which scientific activity is divided; they were, moreover, drawn up by teams of reputable researchers in each field.

The first edition of the *Reports* was organized into 24 thematic areas covering the period 1990–1995. From 2003, the Scientific Secretariat continued with the task of coordinating the second edition, which was published in early 2006, covered the period 1996–2002, and this time included 27 thematic areas. Both editions are now available from the IEC website [<http://www.iec.cat/reports>]. As for the future of *Reports*, a third edition covering the period 2003–2008 is projected that will include an even broader range of knowledge areas.

In 2003, to support the tasks involved in preparing the second edition of the *Reports*, the IEC created the *Observatori de la Recerca* (Observatory for Research, OR-IEC) in response to a detected need for a reference framework for the analysis,

planning, coordination, and communication of R&D&I activities in the Catalan science and technology system [8]. From the outset, the OR-IEC has had two strategic goals:

1. To evaluate developments in different science and technology areas on an ongoing basis using indicative quantitative data (crucial to assisting decision-making by politicians, the business community, and scientists).
2. To place at the disposal of the scientific community and society in general a system of tools as well as up-to-date and retrospective information on the state of research in Catalan linguistic and cultural regions.

At present, the OR-IEC, which is hierarchically positioned within the IEC's Research Support Department, has a staff of three documentalists. It works closely with the Computer Department and is under the academic management of the Science Secretariat. Offering specialist R&D&I information on the Catalan science and technology system, the OR-IEC is present on the Internet through the MERIDIÀ (Measurement of Research, Development and Innovation) web portal. It follows up and disseminates scientific activities carried out by the IEC (programs, academic events, publications, etc.), provides support to Catalan scientific journals, and ensures the continuity of future editions of the *Reports*.

The aim of the OR-IEC is to give both an overview and a detailed perspective on the current state and development of a range of science and technology fields, while avoiding systematic analyses or comparative evaluations of institutions, groups, and researchers. It encompasses the entire research cycle, from inputs to outputs, as well as the socioeconomic arena, research bodies, human, economic, and material resources, and results in the form of dissertations, articles, and patents. The geographical area of study covers all R&D&I activities conducted in Catalan linguistic and cultural regions, with comparisons made at the state and international levels.

All the information on the resources and results of Catalan research available through the OR-IEC is the fruit of key documentation tasks (including the identification, selection, and systematic harvesting of data sources for information for subsequent computer processing) implemented in the five years of the observatory's existence. Information is mainly obtained as follows:

- Agreements for the transfer of information with the Government of Catalonia, universities, and other public and private organizations linked to research.
- Systematic processing of primary (conclusions of official bulletins, statistics, administrative records, etc.) and secondary (memoranda of national research plans, reports, etc.) information sources.

Once processed and standardized, the information is included in a database for subsequent analysis and dissemination.

The MERIDIÀ web portal

Launched for public use in May 2008, MERIDIÀ [http://meridia.iec.cat] [1,2] (Fig. 1) was presented as a tool for specialist users that transforms a large quantity of dispersed and heterogeneous data into knowledge. The data cycle commences with data collection, which is then transformed into information when uploaded to the platform and which terminates with an individual making use of the information to generate knowledge.

Like the OR-IEC, the aim of MERIDIÀ is to observe the evolution of the various fields of science and technology, both globally and in detail, while refraining from systematic analyses or comparative evaluations between institutions, groups, or investigators. From the IEC's rigorous, central and independent perspectives, it is a collaborative initiative whose goal is to integrate and share information with the other agents, thus making available to them an exhaustive body of knowledge regarding their scientific and technological environment.

MERIDIÀ uses indicators established by the Organization for Economic Cooperation and Development (OECD) [http://www.oecd.org] and described in periodically revised methodological documents [7]. The information collected is structured according to the following concepts (Table 1):

- **Socioeconomic context.** Internal costs for R&D&I; staff devoted to R&D&I activities, etc.
- **Human resources.** University teaching staff; scientists-in-training; staff of other R&D&I centers; European, state, and autonomous associations, etc.
- **Financial resources (Origin).** Framework programs (European Union); National R&D&I Plan (General Administration of the State); Research and Innovation Plan (Government of Catalonia); foundations and companies.
- **Financial resources (Execution).** Research programs (IEC); public and private universities; Spanish National Research Council (CSIC); companies; other R&D&I entities.
- **Material resources.** Infrastructure and equipment; libraries and documentation centres, etc.
- **Results.** Scientific journals; scientific production; ISI Thomson Scientific; doctoral theses; patents, etc.

Table 1. MERIDIÀ: indicators groups

Indicator groups	Number of items
Classifications	26
Research bodies	14,129
Financial resources	65,274
Results (journals)	1016
Results (patents)	8727
Results (theses)	12,895

The portal was designed as a technological platform comprising different modules:

- A research database constructed from an underlying conceptual model that would be flexible enough to respond to issues arising from the multiplicity of information sources.
- An internal data management environment that would support information management tasks.
- An analytical environment that would allow information to be harvested for the generation of results in the form of reports [3].
- A website environment that would facilitate the dissemination of results.

The following consultations can currently be made through the MERIDIÀ portal (Fig. 2):

- **Reports.** Generated from the analytical environment, each report is structured according to one or more indicators and according to suitable dimensions (for example, modalities, national R&D&I plans, different autonomous communities, etc.). Additional information includes source, scope, and date of last update. The display portal includes a cross-tabulation mechanism that enables users to view reports from different perspectives in rows or columns and to export data to an office environment.



Fig. 1. MERIDIÀ web portal

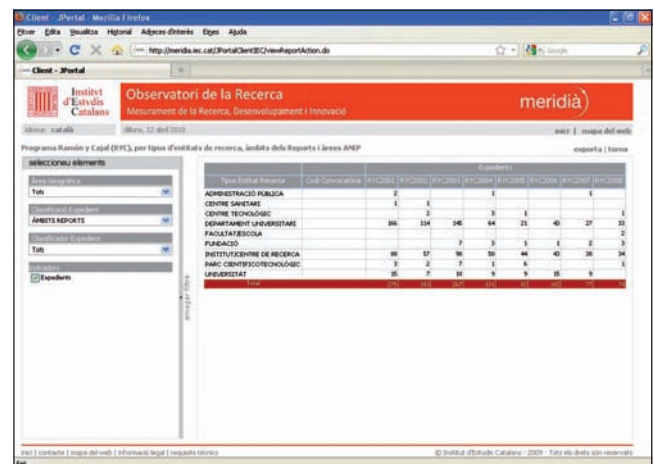


Fig. 2. MERIDIÀ report

- **Relevant documentation.** Additional information includes size, type, publisher, and publication year.
- **Search.** An additional option offered by the Lucene open-source search engine enables searches in the database and in relevant documentation. Not only does this permit indexing and more complex searches (providing a more basic level of information than that provided in aggregated form in the reports), it also enables reports to be contextualized.
- **News.** Up-to-date news on the OR-IEC is provided to users.
- **Links.** Selected website links are offered to users.

The reports date from the year 2000 (in some cases, 1996) (Table 2). Every R&D&I activity developed in Catalonia, the Valencian Community, the Balearic Islands, and Andorra is included, with comparisons made at national and international

Table 2. MERIDIÀ: most significant reports

Socioeconomic context
Total internal expenditure on R&D activities as a percentage of GDP
Autonomous Community expenditure on innovation
Employment in R&D activities (full-time equivalents)
Number of researchers (full-time equivalents)
Resources
Academic-researcher staff
Ramón y Cajal Program (RyC)
University teacher training (FPU) grants and funding
Research staff training (FPI) grants and funding
Catalan Institution for Research and Advanced Studies (ICREA)
Center for Industrial Technological Development (CDTI) projects
Health Research Fund (FIS) research projects
National R&D&I Plan research projects and complementary actions
European Union Framework Programme (FP) research projects
Results
Scientific, cultural, and humanities journals
Scientific production according to Thomson Reuters
Doctoral dissertations
Patent applications lodged with the Spanish Patent Office (OEPM)
Patent applications lodged with the European Patent Office (EPO)

levels. The working classifications of scientific and technical areas are based on those described in the *Reports*, which are considered equivalent to all other taxonomies.

The system developed for managing content includes a security layer that restricts access by users and ensures a capacity to grow on the basis of new types of content that may appear in the future. Additional features of note include the fact that each report provides a detailed explanation of methodology, content, information sources, etc., and the possibility of consultation in Catalan, English, and Spanish.

The system is flexible enough to be able to establish specific profiles for each group of potential users, as follows:

- Public administration personnel holding political posts
- Chancellors and vice-chancellors of public and private universities
- Directors and senior managers in research bodies, research centers, and institutions
- Science and technology policy planners (management and technical staff)
- Members, staff, and affiliates of IEC subsidiary bodies
- Research staff specializing in the description and analysis of R&D&I activities (including scientific production, patents, etc.)
- General and specialist press
- The scientific community and society in general

MERIDIÀ's design is directed at facilitating information access and retrieval by non-expert users. In this sense, quick-access elements are used for highlighted contents and the latest updates. In the same way, the information shown in the different containers can be managed by pre-established order criteria or relevance categories assigned by the system's administrators. As a complement to MERIDIÀ, a blog is planned for 2010 to comment and analyze the available information, promote communication among users, and facilitate subscription to the web portal's updates.

Conclusions and perspectives

Through its MERIDIÀ portal, the OR-IEC makes research data available to interested parties, along with the means for consultation and data analysis. Users can thus locate relevant information rapidly and accurately in response to their queries and searches.

The purpose of MERIDIÀ is to publicize and foster Catalan science by providing detailed information on research agents, resource investment, and results. The portal has a number of strong points, including: its scope is territorial, in that it covers all of the Catalan cultural and linguistic regions and also provides state-level and international comparisons; it embraces the complete R&D&I cycle, from the socioeconomic context to the industrial application of new scientific and technological knowledge; it offers full sectorial coverage (universities, companies, public administrations, non-profit private institutions, etc.) and subject matter coverage (the hard sciences, life and

health sciences, engineering, architecture, the social sciences, the arts, etc.); it guarantees data reliability and quality by relying on certified and credible information sources only; and it makes intensive use of the information and communications technologies (ICT).

Nonetheless, it is also necessary to be aware of the challenges faced by a project of this nature, for example: the huge quantities of data and a vast range of information sources have to be handled; there is a lack of referents and clear models for the conceptual and technological development of the system; there is an urgent need to make the portal known and to ensure a natural symbiosis between MERIDIÀ and the R&D&I system, thus guaranteeing added value.

The combined work of the OR-IEC and research managers and scientists meets a demand for qualitative studies on aspects as central to Catalan scientific research as international impact, interdisciplinary cooperation, other networks, etc. Planned for the future is the development of new indicators from the consultation of electronic serial publications, patent citations, bibliometric studies applied to the arts and social sciences, etc. Another area that requires further development is the systematic harvesting and organization of data on all available material R&D&I resources. Finally, technological transfer mechanisms between universities and the private sector need to be studied, as does the role played by the private sector in scientific and technological research.

In conclusion, the MERIDIÀ portal is an ambitious initiative of the IEC that, for all research undertaken in the Catalan cultural and linguistic regions, aims to provide an umbrella covering more than one-to-one exchanges and the individual interdisciplinary cooperation undertakings by universities and research centers. It is anticipated that the MERIDIÀ portal will become a reference node for the analysis, promotion, and widespread

dissemination of all scientific knowledge developed in the Catalan cultural and linguistic regions within the broader context of a networked society.

References

- [1] Arguimbau L, Cervera A, Latorre R, Martí M, Guerrero R (2008) El portal MERIDIÀ de l'Observatori de la Recerca de l'Institut d'Estudis Catalans: anàlisi, promoció i difusió del coneixement científic català. *Coneixement Soc Rev Univ Recerca Soc Inform* 15:80-105
- [2] Arguimbau L, Cervera A, Latorre R, Martí M (2009) MERIDIÀ: un portal para la difusión de la ciencia desde una perspectiva integral y cooperativa. *Prof Inf* 18:540-544
- [3] Bonifati A, Cattaneo F, Ceri S, Fuggetta A, Paraboschi S (2001) Designing Data Marts for Data Warehouses. *ACM T Softw Eng Meth* 10:452-483
- [4] Callon M, Courtial JP, Penan H (1995) *Cienciometría: la medición de la actividad científica: de la bibliometría a la vigilancia tecnológica*. Trea, Gijón
- [5] Camarasa JM, Roca-Rosell A (2008) L'Institut d'Estudis Catalans al llarg de cent anys de polítiques científiques. *Coneixement Soc Rev Univ Recerca Soc Inform* 14:6-51
- [6] Fuentes E, Arguimbau L (2008) I+D+i: una perspectiva documental. *An Doc* 11:43-56
- [7] OECD (2002) *Frascati Manual 2002: Proposed Standard Practice for Surveys on Research and Experimental Development*. OECD, Paris, 256 pp.
- [8] Vega I (2007) *Tipología de observatorios de ciencia y tecnología. Los casos de América Latina y Europa*. *Rev Esp Doc Cient* 30:545-552

About the authors

Llorenç Arguimbau has a Ph.D. from the Autonomous University of Barcelona. He graduated from Art History and has a B.A. in Biblioteconomy and Documentation from the University of Barcelona. He also has a postgraduate diploma in Cultural Management from Pompeu Fabra University (UPF). He has worked as a librarian at the UPF and as consultant for the Open University of Catalonia. He currently directs the Observatory for Research of the Institute for Catalan Studies (OR-IEC) and is adjunct lecturer of the Area of Documentation of the UAB.

Aldara Cervera has a B.A. in Biblioteconomy and Documentation and a B.A. in journalism from the Autonomous University of Barcelona, and a master's degree in Management of Digital Contents from the University of Barcelona-Pompeu Fabra University. Currently, she works as a documentalist at the Observatory for Research of the Institute for Catalan Studies, and has collaborated in different libraries and with the media.

Mercè Martí has a B.A. in Biblioteconomy and Documentation from the Autonomous University of Barcelona, a degree in Teaching from the University of Vic, and a specialist course in Information for the Management of Innova-

tion and Knowledge Management from the Open University of Catalonia. She has worked in the Office for Project Management of the Internet Interdisciplinary Institute. Currently, she works as a documentalist at the Observatory for Research of the Institute for Catalan Studies.

Robert Latorre has a B.A. in Computer Science from the Technical University of Catalonia. He has worked in technological companies such as Centrisa, Teleinformàtica, and Azertia as a consultant and participating in the set up of different information systems. He is currently a project leader in the IT Department of the Institute for Catalan Studies.