

Improving Scientific Research in Higher Education Institutions: a Process Management Experience in Italian Universities

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Abstract: Scientific Research is one of the core pillars on which Higher Education Institutions are built and operate; its effective governance is a mission-critical task and an ever-important competitive factor for Universities today. The aim of this paper is to share the experience of Italian Universities in managing Research processes, through a supporting software system developed by CINECA, the leading Italian interuniversity consortium, called U-GOV Research; a system that supports the structured management of the projects life-cycle, by collecting, storing, publishing, and evaluating the internal scientific research production of a University.

Key Words: Information Systems, Applications, University, Administration, Research, Projects, Publications, Assessment, Management.

1. CINECA at a Glance

CINECA was founded in 1969 as an Inter-university Consortium and has become the largest high performance computing center in Italy and among the most important worldwide.

Over time it has expanded its range of activities to support Higher Education Institutions and the Italian Ministry of University and Research in all key sectors of Information and Communication Technology.

CINECA's aims are the following:

- to support the research activities of the scientific community through supercomputing and applications
- to develop information systems and services for Higher Education Institutions
- to act as the information technologies outsourcer of the Italian Ministry of University and Research

- to enable the public administration and business companies to achieve real benefits with activity of technology transfer and specially designed products and services.

2. CINECA and Higher Education

Higher Education Institutions (HEI) have unique organizational models and core processes compared to other business realities. Therefore CINECA is focused on developing information systems to support the specific HEI needs, instead of re-engineering ERP systems developed for other markets. It provides as well a wide service offer, including hosting, networks, communication systems, portals and many others.

CINECA, as a consortium of universities, can leverage the domain expertise guaranteed by its members to better understand the needs of the market and serve it accordingly. Its long experience in academia allows CINECA to offer effective solutions, oriented to the governance as well as to the day-to-day management; thus promoting the mutual transfer of knowledge to improve service quality.

Since the 1990's CINECA has supported Italian universities developing applications for the management of the main administrative areas:

- HR/Personnel Management
- Accounting Management
- Student management system
- University Datawarehouse and Dashboard.
- Research Management.

With the U-GOV Project, in 2005 CINECA has set in motion a new integrated information system for universities, U-GOV, which channels into a single systemic vision the CINECA software solutions so far offered.

All these activities prove CINECA's significant commitment to Higher Education. CINECA is investing roughly 20% of its overall revenues in the HE systems research and development.

3. Research Management in The Italian Universities: Vision and Development Guidelines

It is generally accepted that the core processes of Universities are two:

- Teaching
- Researching.

The "Teaching" process (the knowledge transfer to students) is probably the most obvious and important mission these organizations have to fulfill.

For this reason Italian Universities have always been focused on improving their knowledge base (hiring the best teachers) and developing better processes and services in order to increase the knowledge transfer to students.

On the other hand, the "Research" process hasn't been managed as carefully as the "teaching" process, since it hasn't usually been considered the "core" of these institutions.

However, every Italian HE Institution now understands that the Research process should be managed as carefully as the Teaching process.

Experience and close collaboration in the university world has permitted CINECA to identify and understand the lines of development that are guiding the management of research activities and processes in universities.

These are:

a) Project lifecycle: from definition to accounting

Italian Universities manage different kind of research projects: they may differ for origin of funding and for the specifications that regulate them. Despite this, universities need to manage all projects underway within a standard process which identifies various common operative phases, regardless of the nature of the financing body, identifying the convergences and synergies between the processes of development. To achieve this CINECA aims to offer universities the control of the entire life cycle of research and a single information base for optimizing the management of funds.

b) Management and assessment of scientific publications

Identifying the excellence developed internally and improving the quality of scientific publications has become one of the main needs of universities. The objective is thus to provide systems for collecting and cataloguing all the internal scientific publications and coordinating the assessment processes.

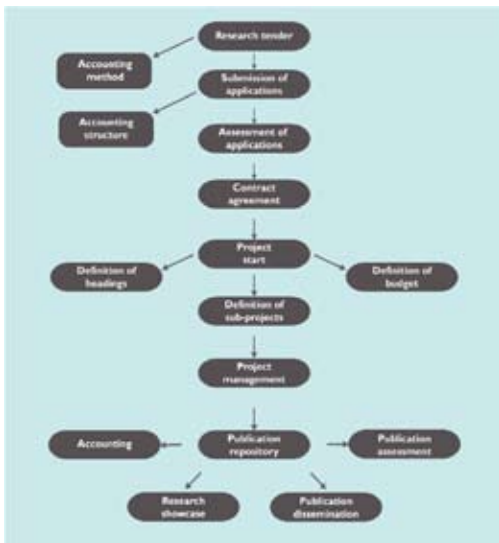
c) Publications and skills showcase: dissemination of research results

One of the institutional missions of the university is to develop internal skills and resulting publications making this heritage available in the local territory and within the local and national economic system. Accordingly, Universities have realized the importance of opening

their research system and distributing their experience to the local area and companies.

Today, in The Italian HE world, excellence in research is an important factor for securing finances not only from government sources but also from alternative sources, like companies, the Public Administration, the European Community, and other bodies.

A university must thus distribute and make available its patrimony of skills and resources in an accessible form that can be exploited by interested organizations.



This image shows University Research Processes

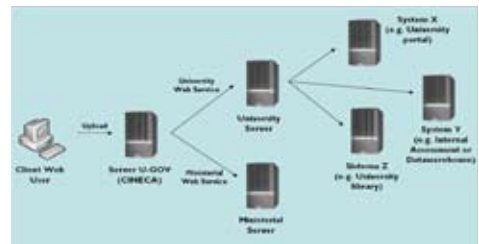
d) Integration between the national dimension and the university

In Italy the management of publications requires a high level of integration between national repository systems and the university applications to ensure the streamlining of the processes and lightening of workloads for the teachers and administrative offices involved.

Similarly the assessment criteria for the scientific publications must comply with two separate typologies: the criteria defined on a national

level by the assigned bodies and the qualitative objectives defined locally by each individual university. In Italy for example, there is a national organization created by the Ministry of University and Research whose mission is to develop a national assessment of scientific publication in order to find, evaluate and support the best universities and research groups.

Finally, in order to quicken and simplify the requested project's data exchange, Italian Universities need a close integration with the Italian ministerial system and web site for national projects and with the European Community web sites and systems for European projects.



This image shows data exchange and dissemination processes

e) Integration with information and processes in other internal administrative areas

Research is certainly an area that transversally involves the activities of the entire university. The specific processes of this area integrate a stream of information arriving from the other main administrative areas, like accounting (for example for the financing aspects) and human resources (for example for information on teachers and researchers). In this respect ad hoc solutions to cover individual functional areas are proving to be inadequate to satisfy the new requirements that the university has to satisfy.

It is necessary to share and integrate the processes of development/assessment and the information relevant to projects, finished goods, and the bodies involved.

f) Management and Governance in a single system

CINECA aims to offer not only instruments to best support the management of the research processes, but also systems with a more marked orientation towards governance, permitting universities to define policies to stimulate the high quality of the results and organize strategic development programs.

4. U-GOV Research: Benefits for Italian Institutions

In 2006 CINECA started the development of a new system for the management of the research activities. This system, called U-GOV Research, was born as part of a wider integrated system, U-GOV.

Collaboration was promoted from the beginning with some Italian Universities which provided an important contribution of the skills and professional capacities they had available.

The responses of U-GOV Research to the complexity and scale that characterizes the research area today are articulated in the following points:

a) Project lifecycle: from definition to accounting

U-GOV Research offers important characteristics and functionality for project management: organizational structuring decoupled from financial management, cost budget and cost headings that can be implemented in relation to the characteristics of the project, support for a more detailed internal control, reporting structures on the basis of the requests of the financing body.

b) Management and assessment of scientific publications

With U-GOV Research each university can file and consult all the research publications. IN addition the university can manage the assessment

process, fixing and configuring assessment criteria for each publication type, and can apply an automatic assessment to speed up the identification of higher quality, also allowing the use of nationally recognized indicators (for example the “impact factor” of journals). It is also possible to create the assessment sessions assigning the publications to assessors and managing the feedback. At the end of the process the system provides statistics and rankings.

U-GOV Research provides teachers and researchers with a unique entry point from where they can manage their scientific publications and their relationships with the university and the Ministry.

c) Publications and skills showcase: disseminate the research results

CINECA develops this process through the implementation of the tracing of all internal activities, instruments, resources, and skills and encouraging openness and distribution of figures and information for the publication of and assessment of excellence.

d) Integration between the national dimension and the university

To achieve this CINECA offer a high level of integration between the Italian national repository systems and the University publications repository, ensuring close synergy, streamlined processes, and lightening the workload on teachers and the administrative offices involved.

Meanwhile, the CINECA application offers integration with the ministerial web site for national projects’ data exchange.

U-GOV enhance the work of teachers and researchers simplifying the access procedures to finances, providing project heads with information, including accounting updated in real time and improving the management of the available resources. It offers support for the management of the resource supply procedure

and cost-items budget change process. The openness and integration of the system also facilitates the coordination of projects developed in partnership with other organizations.

e) Integration with information and processes in other administrative areas

The transverse integration in U-GOV of the data from the different functional areas is the essential basis for implementing control instruments or improving the integration of offices (for example with the sharing of the university's organizational structure and the data for the teachers and researchers).

f) Management and Governance in a single system

CINECA offers Business Intelligence and BPM/Dashboard applications integrated with the research information system in order to get the broad vision on the processes and to control results.

This is possible thanks to dynamic monitoring, constantly updated for the state of advance of each individual project and the use of financial resources, personnel, instruments, and skills involved in this activity within the university.

5. U-GOV Research: Modules and Functions

U-GOV Research is currently composed of three modules described in the following sections.

1) Publications Repository and Assessment

The Research Catalogue and Assessment module was one of the first U-GOV modules ever released.

This module makes it possible to file and consult all the research publications and to manage the assessment processes.

Repository of scientific publications

To facilitate the creation of a repository, the module includes the option to automatically

load all the publications inserted by teachers or other university staff into international archives. In this complex initial phase an ad-hoc application simplifies the identification and possible elimination of duplicates. The same duplicate recognition functionality can be activated by users during the insertion of new research products.

The personalization of the functions, cataloguing rules, and attributes do not require intervention on the program source code. These are defined and configured during the set-up phase ensuring the university maximum flexibility and speeding up issue times.

Created within the architecture of the U-GOV system, this module can combine data from other functional areas (Accounts, Resources, Human Resources, etc.) for example acknowledging the research authors (teachers, researchers, etc.) belonging to the university, giving their legal status and thus the faculty, department, and scientific sector to which they belong. At the same time the close integration permits analyses cross referencing the information in the publications repository with financial, economic, and organizational data.

Through the use of web services the Publication Repository and Assessment module of U-GOV integrates with the existing applications and in particular with the university's institutional portal. All this permits the university to fully exploit the potential of the U-GOV system, displaying the data and functionality to distribute access, consultation, and use.

The integration with the Italian ministerial web site permits the Publications Repository to automatically maintain synchronization of data on the ministerial web site. The university lecturers thus manage the archive of their publications using U-GOV as a single interface: through U-GOV they can use the entered data both for ministerial purposes and within the university.

Assessment of scientific publications

The Publication Repository and Assessment module quickly and efficiently manages the assessment of the publications in the repository. The module permits the configuration of the assessment session depending on the needs of the university.

The division of work is simplified by an interface that makes it possible to create publication categories or authors and to assign them to different assessors. The university establishes the assessment criteria for each publication type.

Multiple types of assessment can be expressed for a single publication and for each type there can be multiple individual assessments from different assessors. It is also possible to automate an initial phase of assessment on specific publication types, reducing the intervention of assessors only to necessary cases.

The application permits assessors to express themselves through a predefined range of judgment, to indicate classification anomalies, duplications, or errors identified during assessment. To monitor the development of activity the governing bodies, assessors, and Research Office can display the statistics for the state of advance of work at any time.

The final assessment foresees a summary judgment, which can be indicated manually or calculated automatically through predefined rules. Final statistics and reports are available on the concluded sessions and the judgments expressed. If the university considers it necessary the system also permits the activation of a function for the management of appeals from the assessed subjects.

The classification of the publications used by the assessment system is independent of that applied within the catalogue. This characteristic makes both cataloguing and assessment simpler and more flexible. In the assessment

phase it is possible to reorganize the publications in ad hoc categories on the basis of the criteria chosen by the university, without this subdivision influencing the existing catalogue classification.

In the future CINECA plans to extend the assessment functions to permit the use of the same application logic also for the assessment of other “entities”, always within the research area, like for example projects, resources, and structures.

2) Project Management

The functionality of the Project Management module extends far outside the context of research, raising this module to the status of a transverse element operating across the entire U-GOV system.

The module makes it possible to monitor all research projects active in the university from an operative and financial perspective. From the university’s point of view the Project Management module provides the instruments for the control and coordination of all active research projects, regardless of whether these are financed with internal or external funds. These can be monitored as part of the management of resources like personnel, equipment, and logistics. At the same time Project Management also represents an instrument of integration and connection between the organization of project activity, requests for resources that initiate management cycles, and the financial aspects of the project referring both to the organizational units and to the cost centers of management accounting.

To enable the management of all project types that can be implemented in Italian universities, further requirements are added to these, deriving from the teaching world (for example for teaching projects financed by the European Social Fund) or from the world of human resources (for example for the management of training proj-

ects for internal university staff). Consequently the original design of a set of Project Management functions within the research sphere was modified promoting Project Management to a module in itself, interacting transversally with all the other U-GOV modules.

From the perspective of the financial management of a project, Project Management simplifies the correspondence between the cost items derived from an Italian national tender and the accounting in the financial statements of the body that manages the finances. At the time of creation of the project derived from an Italian national tender, Project Management has an automatic import system for the project data (cost items, budget, resources, deadlines, purchase of materials, etc.) directly from the ministerial web site. The university can add additional information of their interest to this data, like for example a more detailed description of the cost items to permit a more detailed understanding of the project costs.

From the point of view of lecturers and researchers the system offers support in the various steps in the realization of the project: From the purchase, enrolling and organization of the necessary resources to the compilation of cost statements and financial reports, to the estimate of the work in progress, and the production of reports for the control bodies. The close integration between the operative and financial data makes it possible to extract the accounting data for an expense at the end of every research project and the communication of the project balance to the financing body.

3) Research Resources Management

Research Resources makes it possible to bring together, organize, and consult all the information relative to the research activity conducted within the university. The module gathers and manages information regarding:

- The research structures.

- The groups, teachers, researchers, and other personnel involved in the research activity.
- The research projects and activities conducted, with all the data relevant to the disciplinary aspects, scheduling, resources utilized, costs, and logistics.
- The laboratories and equipment useful for the development of the projects.
- The scientific skills developed.

The information patrimony managed by Research Resources is designed as a base for initiating processes of governance of university research. Using this centralized archive the university can establish at any time the state of advance of projects, down to the detail of the entities (finances and resources) involved in individual projects. The integration and cross referenced analysis of the information collected (also originating from the other applications of U-GOV) enable the definition of a complete overview of scientific activity from different analytic perspectives: On a university level, by structure, by individual lecturer and researcher.

As already stated, one of the main objectives of the university is the exploitation of internal scientific skills, raising the profile of the best scientific production. In response, Research Resources facilitates the definition of a “shop window” of know-how, resources, and research activities to promote contact and collaboration with local companies and organizations, simplifying the work of the ILO’s (Industrial Liaison Office). Through web services the Research Resources data can be exported in real time to the institutional university portal and other applications.

Relative to Research Resources, the data managed by Publication Repository and Assess-

ment represents the patrimony and tangible result produced by projects, which is most usefully consulted and assessed in a separate process from that of management of the data base of other research resources. For this reason the decision was made to manage research publications in a separate specially designed module.

6. The Next Challenge: Integration Towards The European Research Area

The European Union and all the EU member states are committed to develop a common European knowledge area throughout two lines of direction:

- The European Higher Education Area. It includes 46 states and is driven by the Bologna process.
- The European Research Area, driven by the Berlin Declaration.

The discussion during European Councils concerning the research activities remarked that European universities are not currently in a position to achieve their potential: HE institutions are behind in the increased international competition, they lack of flexibility in order to adapt to the changing research agendas and suffer excessive public control.

As a result, the European Research Area aims at coordinating national research policies and Union research policy: career structure synergy, scientist mobility and exchange, access to scientific publications and data exchange, support for cooperation between universities and research groups, promotion of peer review assessment.

CINECA is looking at this process in order to support its customer universities with the best solutions for these issues:

- Publications Repository standards (Open Archive, euroCRIS CERIF standard, Driver Project).
- EU Research Project data exchange with CORDIS.
- EU Research Project data exchange between partner universities.

7. Results

Today we number the installations of U-GOV Research in about twenty Italian universities, including Bologna, Ferrara, Florence, Lecce-Salento, Milan Politecnico, Milan “Bocconi”, Modena e Reggio Emilia, Naples “Federico II”, Pavia, Turin, Trento, Venice IUAV, Verona.

Thanks to this solution these Universities have developed a single database of scientific publications, a basis for monitoring and assessing publications and checking achievement of objectives. This repository also simplifies the publication and dissemination of this material through portals and websites and leverages the relationship and the transfer of know-how and technologies to the territory and to business companies.

Similarly, U-GOV supports researchers in managing their publications catalogue, and submitting the calls for national projects and funding requests.