HERCULES PROJECT
A System for Universities with Research Data Semantically Enriched

euroCRIS May 2022

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Hercules is an initiative promoted by the Conference of Rectors of Spanish Universities (CRUE) and led by the University of Murcia. It has a total budget of Five million four hundred and sixty two thousand six hundred euros (5.462.600 €). The European Regional Development Fund (ERDF) is financing 80%, therefore the ERDF makes a contribution of Four million three hundred seventy thousand eight hundred euros (4.370.080 €). This contribution is made through the Ministry of Economy, Industry and Competitiveness (currently the Ministry of Science, Innovation and Universities) as Intermediate Body of the Smart Growth Operational Programme (POCint), which now is known as the Plurirregional Operational Programme of Spain (POPE).

It started in 2017 and it is foreseen to end in 2022.
**Background**

- 84 Universities having different Research Management Systems
- Each university has its own procedures and the systems are based on different data models and schemata
- Poor standardization
- Transfer of research results to the society is done in a disaggregated way
- Inefficiencies in knowledge management and dissemination
- Additional costs to use combined research information
- Difficulties to access European Funds
- Data representation is done with different granularity

**Needs**

- Integration of normalized CV
- Transparency
- Collaborations between universities and research groups
- Unify the criteria used to extract the information
- Open Access of research results to the society
- Availability of combined information from different universities/sources
- Improvement of the technological transfer and collaboration University-Company
Convenant with Hercules

EUROPEAN REGIONAL DEVELOPMENT FUND (ERDF)
A way to make Europe

Hercule’s Universities

- Universidad de León
- Universidad Pontificia de Salamanca
- Universidad de Salamanca
- Universidad de Cantabria
- Universidad del País Vasco
- Universidad de Deusto
- Universidad Internacional de La Rioja
- UNED
- Universidad Complutense de Madrid
- Universidad Rey Juan Carlos
- Universidad Camilo José Cela
- Universidad de Extremadura
- Universidad de Córdoba
- Universidad de Granada
- Universidad Pablo de Olavide
- Universidad de Huelva
- Universidad de Córdoba
- Universidad de Almería
- Universidad de Sevilla
- Universidad de Zaragoza
- Universidad de Valencia
- Universidad Politécnica de Valencia
- Universidad Católica de Valencia
- Universidad de Murcia
- Universidad Católica de Murcia
- Universidad Politécnica de Cartagena
Intellectual Property Rights

GPLv3

General Public Licence

It is free to facilitate the deployment in all universities
Results of the Hercules project

Advanced National Research Portal for Spanish Universities
By using Semantic and Artificial Intelligence Technologies

- Advanced Search
- Dashboard Research Indicators
- Collaboration Clusters

Tool for the Management and Enrichment of researcher’s CV
By using Data Enrichment and Artificial Intelligence Technologies

Semantic Arquitectura and Research Ontology
## Current status

<table>
<thead>
<tr>
<th>Projects</th>
<th>Scope</th>
<th>Due Date</th>
</tr>
</thead>
</table>
| Innovative prototype of the Research Management System | Research Ethics Management Module  
 Calls management Module  
 Request Management module  
 Projects, Grants and Contracts Management Module  
 Intellectual and Industrial Property Rights/Patents Management Module | September 2022 |
| Tool for the Enrichment and Management of Researcher’s CV | Curriculum Management Tools (Spanish Standard CVN)  
 External Internet Sources Integration  
 Semantic Similaritu. Topics Extraction.                     | September 2022 |
| National Research Portal for Spanish Universities | Projects, Researchers, Research Groups, Papers, Patents and other Research Objects portal. | September 2022 |
Ontological Infrastructure and Semantic Architecture

The products that have been provided are:

- **Ontological Infrastructure**: creation of an **Ontology Network** that can be used to describe the data of the research domain with fidelity and high granularity.
  - Using already existing ontologies
  - Aligned with FAIR principles.
- **Semantic Data Architecture**: developing an efficient platform to store, manage and publish research information. It is based on the Ontological Infrastructure, with the ability to synchronize instances installed in different universities.
ROH. Domains

- The ROH has been designed using different files or “ontologies” for different domains.
- In the scope of the Hercules’ Project 3 ontologies have been created:
  
  o ROH – General research information
  o ROHES – Spanish specialised information
    ▪ rohes:Account – Account System
    ▪ Derived of roh:AcademicAccreditation and rohes:Sexenio
    ▪ Derived of vivo:FacultyPosition
    ▪ rohes:Tax
  o ROHUM – University of Murcia specialised information
    ▪ rohum:GastosCorrientesYServicios
    ▪ rohum:InversionesReales
Innovative Prototype of a Research Management System

The development of an innovative prototype of the Research Management System for UNIVERSITIES.

- Communication with Semantic Architecture projects.
- Implementation of a pilot at the University of Murcia
- Documentation and training

Acquisition of equipment or infrastructure is not included in the scope.
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06 CV Management and Enrichement Tool

07 Conclusions

José Tomás Palma Méndez
UM Research Coordinator
Objective

Advanced National Research Portal for Spanish Universities

By using Semantic and Artificial Intelligence Technologies

- Advanced Search
- Enriched Information
- Semantic Similarity

- Dashboard.
- Research Indicators.

- Tools for the creation of collaborative clusters.
Objective

Advanced Research Portal
Semantic and Artificial Intelligence Technologies

Advanced Search
Enriched Information
Semantic Similarity

Dashboard
Research Indicators

Tools for the creation of collaborative clusters.

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Metasearch

- Single query point
- Information dynamically and automatically retrieve from Knowledge graph
### Specific facet-search system

- Publications
- Researchers
- Research Groups
- Projects
- Research lines
- News
- Entities (departments, research groups, ..)
- Other research results (software, bioprotocols, ..)

### Infoboxes (enriched information in search process)
Entity navigation / enriched web pages

- Researchers
  - Publications
  - Research topics
  - Collaborations
  - Projects
  - Research objects
- Research Groups
  - Same structure as Researchers page.
Dashboard

Main indicators

<table>
<thead>
<tr>
<th>Research</th>
<th>Enterprise activities</th>
<th>Post-graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Process</td>
<td>Output and Outcome</td>
</tr>
<tr>
<td>Applications, awards, success rate</td>
<td>Income, market share</td>
<td>Publications &amp; citations,</td>
</tr>
<tr>
<td>academic-industry, business</td>
<td>Contracts, project financial data</td>
<td>collaboration, societal</td>
</tr>
<tr>
<td>consultancy</td>
<td></td>
<td>impact</td>
</tr>
<tr>
<td>Reseearch student funding</td>
<td>Student &amp; academic staff</td>
<td>Intellectual Property, Spin-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Offs, Technological offer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time to doctoral degree,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>destination of research</td>
</tr>
<tr>
<td></td>
<td></td>
<td>student leavers</td>
</tr>
</tbody>
</table>

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A way to make Europe
Research Dashboard

- Facet based navigation according to a predefined hierarchy
- Aggregation of Indicators over a period of time.
- Visualization of the evolution of the indicators according to the timeline.
- Prediction of the evolution of the indicators.
- Detection of trends in different Research Areas
Project Team
Recommender / Cluster builder

- Different research topics taxonomies
- Different roles and their associated research topics
- Visualization
- Facet-based refinement
- Complete access to Researchers CV
Benefits

- Joint exploitation of university research information
- Enabling greater scientific dissemination of research results
- Facilitate the detection of R&D synergies between universities and/or research groups.
- Strengthen the transfer of R&D results to the private sector and university-industry collaboration.
- Unify the criteria for information gathering, offering greater guarantees of an adequate interpretation and, therefore, the accuracy of the obtained indicators.

Creation of a research portal with semantic capabilities and infrastructures.
Objective

Management and Enrichment of Researcher’s CV
Using Data Enrichment and Artificial Intelligence Technologies
Scientific Publications, References and Citations

Protocols

Other research objects
(Dataset, Presentation, Graphics, Docs, Links, Video, Poster, Lesson)

Anotaciones

University Management Systems

WoS, Scopus, OpenAire

CrossRef, OpenCitations, SemanticScholar

Zenodo, FigShare, SlideShare, OpenAire

Academic Information, Formal and non-formal training, Personal data, Innovation, etc.
5 · Actividad científica y tecnológica

- Publicaciones, documentos científicos y técnicos (169)

- The Challenges of Software Cybersecurity Certification
  01/01/2021  Jose Luis Hernandez Ramos, Sara Nieves Matheu Garcia, Antonio Fernando Skarmeta Gomez

- An Artificial Intelligence-Based Collaboration Approach In Industrial IoT Manufacturing: Key Concepts, Architectural Extensions and Potential Applications
  01/01/2020  Alfonso Pablo Ramallo Gonzalez, Antonio Fernando Skarmeta Gomez

- An Interledger Blockchain Platform for cross-border management of Cybersecurity Certifications
  01/01/2020  Jose Luis Hernandez Ramos, Sara Nieves Matheu Garcia, Antonio Fernando Skarmeta Gomez

- ARIES: Evaluation of a reliable and privacy-preserving European identity management framework
  01/01/2020  Jorge Bernal Beramble, Antonio Fernando Skarmeta Gomez

- Conceptualisation of an IoT Framework for Multi-Person Interaction with Conditioning Systems
  01/01/2020  Alfonso Pablo Ramallo Gonzalez, Pedro Javier Fernandez Ruiz, Miguel Angel Zamora Izquierdo, Antonio Fernando Skarmeta Gomez

- Trabajos presentados en congresos nacionales o internacionales (0)
User perspectives in the Design of Interactive Everyday Objects for Sustainable Behavior

Addressing efficient management of energy has become a central objective due to the scarcity of traditional energy sources and global warming. To cope with this overarching issue, some technological solutions such as Smart Grids, Internet of Things or Demand response are proposed. However, the majority of them overlooks the role of human beings in the equation. Moreover, the very nascent body of research combining human and machine intelligence proposes methods, frameworks, and guidelines which vary depending on the application scenario complicating the selection of gold-standards to ensure seamless cooperation between smart devices and people. Hence, the purpose of this paper is to provide a set of design-hypotheses to devise augmented objects that ally with their users to reduce energy consumption. We expect designers, engineers, makers or even hobbyists in the intersection between technology-enablers (through IoT) and behavioural scientists to benefit from them.
Benefits

- Enhance efficiency in CV management for Spanish researchers
- Increasing the quality and completeness of university research data
- Value and raise awareness of all research objects that are part of the research process.
- Facilitate the integration of the CVN. Greater mobility for teaching and research staff between Spanish universities.
## Implementacion Process

<table>
<thead>
<tr>
<th>Projects</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot Project</td>
<td>University of Murcia</td>
</tr>
<tr>
<td>National Research Portal</td>
<td>Universities in Hercules Consortium</td>
</tr>
<tr>
<td>National Research Portal</td>
<td>Universities outside Hercules Consortium Conection via API</td>
</tr>
</tbody>
</table>
Conclusions

- **HÉRCULES** will entail the incorporation into the Spanish University System of a *highly innovative* product that incorporates *semantic web* technologies that will allow us to obtain new information by integrating existing information from multiple nodes with heterogeneous ontologies and vocabularies, enabling greater inductive knowledge from apparently unconnected data.

- As *open-source software*, these techniques will be applicable to a wide range of geographical and knowledge environments.
Conclusions

As a public service, the implementation of HÉRCULES will be a great step forward as it will allow the different University Information and Research Nodes to interoperate in a semantic way, resulting in:

- Improvement in the **efficiency of research management** in terms of licensing and software maintenance costs.
- Greater **efficiency in public investment** by decreasing duplication of R&D&I investment.
- Enhancement in the **efficiency of research** in universities.
Conclusions

- Improve the **scientific dissemination** of research results.

- Create systems to support the **detection of R&D&I synergies** between universities.

- Possess **semantic capabilities** to strengthen the transfer of R&D&I results to companies.

- Create a system for university research **data analysis**.

- **Improve interoperability** with the corresponding European, national and regional governmental bodies.
Thank you for your attention

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