AcademIS: an ontology for representing academic activity and collaborations within HEIs

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ABSTRACT
Higher Education faculty performs both research and teaching activities. Now, more than ever, there is an imminent need to capture these activities, as well as the interactions between the academics, for evaluation and networking purposes. Research and teaching are the main quality indicators of Higher Educational Institutions' offered services and curricula. They determine the level of growth and progress of an academic unit and of the individuals serving its cause. As a direct consequence, valuable results can be derived from the processing of this information. This paper introduces an ontology for the representation of the educational and research activities carried out within the academic context with emphasis on the formulation of collaborations among the academic staff. On the basis of the developed ontology, it also illustrates services and tools for supporting the quality evaluation processes of academic organizations, in particular through visualization of teaching and research collaboration networks. Additionally, it incorporates scientists' and academics' networking capabilities. It therefore constitutes a system that can be used to support HEIs in processes related to the evaluation of research, educational and collaboration activity among academics.

Categories and Subject Descriptors
D.2 [SOFTWARE ENGINEERING]: Software architectures, Interoperability, H.4 [INFORMATION SYSTEMS APPLICATIONS]: Decision support

General Terms
Algorithms, Design, Standardization, Management.

Keywords
Academic Information Systems, ontologies, research, teaching, collaboration, visualization, decision support

1. INTRODUCTION
Teaching activities constitute one of the main goals of Higher Education Institutions (HEIs) and a significant quality indicator of their performance and contribution to the society. In combination to teaching, research has an increasingly important role within the current Higher Education (HE) setting, as it is inextricably linked with innovation and progress [18]. Academic institutions in Europe and worldwide strive for excellence and invest on the establishment of efficient quality assurance systems and processes in order to improve their effectiveness in both directions [3]. Quality assurance is an intriguing and complex process [11] based on methods and tools for capturing past performance and measuring future capability. HEIs' evaluation and quality assurance is built around indicators including the quality of teaching, research, services provided, and offered curricula [19,6]. Thus, it is of vital importance to capture, measure and analyze the activities connected with these indicators. Depending on the focus of the evaluation, different dimensions of institutional activity must be considered and analyzed [14]. Moreover, the relationship between two of the before mentioned indicators, namely teaching and research, has always been a topic of interest in HEIs [16].

Apart from responding to the explicit requirements of quality assurance, HEIs also need to develop processes and tools for strategic planning and consultation to their communities. For example, it is essential for institutions to be able to capture research and teaching activities, identify the relationships resulting from them, and enable the facilitation of services that assist the networking of researchers and academics.

Networking and collaboration within scientific and academic communities is an essential factor for the promotion of research achievements and contributions [5], the "open discourse" [10] and the increase of the availability of relevant resources to the community [10]. Furthermore, quality and efficiency of research are also ameliorated with more and better communication [8]. To elaborate, nowadays, researchers need to share their research results in wider audiences, to establish relationships within their institution, or at a larger scale. They also tend to cooperate interdisciplinary and cross-institutionally [7]. Thus, new ways must be found to support the researchers on finding new collaborations, grants and research possibilities. Moreover, this information must be accessible by other researchers and presented in a clear and efficient way. The science networking applications that are based on Web 2.0 are usually referred to as Research 2.0 or Science 2.0 [21].

However, academics have to fulfill a dual role; they are not only interested in their research activities and collaborations; they are also affected by their teaching activities and co-operations. Research is a factor of crucial significance in HEIs; nevertheless an issue of equal importance is the educational activity of academics.

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Thus, there is an imminent need for capturing not only the research and scientific activities and collaborations, but also for monitoring the co-operations between academics, the courses they are involved in and the overall instructional activities in which they participate. In order to achieve quality standards in a HEI, the teaching activities must be structured in a certain way and must follow several rules and regulations. Through monitoring and analyzing the academic activity in a HEI, significant information can be derived regarding past performance. This information can also be used for the policy making of the organization. Based on the same information, steering and consultation services can be provided so as to support the professors and guide them through their academic planning.

In this paper, we start by presenting the problem (Section 2) and the related literature review (Section 3). The developed ontology and a case study for a specific academic department with the use of the proposed ontology is described and discussed thoroughly in Section 4, whilst the developed services for quality evaluation are described in Section 5. The paper ends with conclusions and considerations for future work in Section 6.

2. PROBLEM DEFINITION

2.1 Infrastructures for evaluation and quality assurance of academic units

The evaluation of an academic unit includes the gathering and analysis of data focused on several indicators that are important for the smooth functioning of the organization. Evaluating the quality of academic institutions depends, among other factors, on the research activities that take place in the specific institution [9]. Performance measurement and accountability are gaining more and more importance as far as the evaluation and quality of HEIs is concerned [2]. In this context, databases and repositories containing relevant information for research and academic activity can also be used in the evaluation process of HEIs as indicators of their quality.

Furthermore, this information can be utilized by systems that depict research and instruction related activities and networks. These networks form the basis of capturing present and promoting future intra and inter-institutional collaborations among researchers and academics. There are several systems that depict solely research or teaching activity, but there is lack of contribution to the capturing and measurement of the combination of both activities in HEIs. The proposed solution, not only facilitates evaluation and quality assurance processes, but also supports decision making processes based on the system's database.

2.2 Representation of academic/research activities and collaborations

A way of capturing the activities and relationships between the academics is the use of ontologies. An Ontology is knowledge which is formed based on the principles of conceptualization [4]. Among the main advantages of using ontologies are their reusability and shareability. In particular, the ontology used in this study is based on linked open data and stores its contents in RDF format; as a direct consequence it is interoperable [1,13].

Several approaches have been introduced in order to capture and visualize the relevant information of academics and their activities, both in the research and education areas. A wide variety of services have been set up in order to support the professional networking of researchers. In this paper, we present a novel service developed and tested for a specific academic department within a Greek HEI. However, the proposed solution can be scaled up to support the whole institution, or several institutions. Furthermore, the selected approach can support several data processing methods, such as the harvesting and the import of records, the manipulation of data, the export and the visualization of resulting data, as well as their reuse.

3. LITERATURE REVIEW

As aforementioned, a HEI must follow several rules in order to operate efficiently. The overview of these guidelines is very useful in order to understand which aspects of an educational institution have to be monitored and which issues a system for academics must focus on. The most important policies, that affect the function of a HEI and therefore have affected the development of the proposed system, are described in the following section.

3.1 Overview of quality related policies

3.1.1 Quality assurance and evaluation of HEIs

Every country follows its own guidelines and rules for the evaluation and quality assurance of academic units and institutions. However, some of the rules used for the evaluation of HEIs, the most basic and common ones, apply to the majority of academic institutions regardless their country of origin. Additionally, HEIs within the European Union have to respect both their national sets of quality and evaluation criteria, as well as the ones defined by the European Union and its agencies [20].

As a result, in order for a quality assurance service of a HEI to be developed and applied to a specific academic unit, many things have to be considered. First and foremost, the rules and the guidelines constituting the internal policy of the HEI have to be taken into account. Furthermore, the national policies and strategic priorities need to be taken into consideration. The degree of compliance with the set of guidelines should also be examined.

3.1.2 Education and research quality policies

Since the setting up of the European Higher Educational Area (EHEA), followed by the setting up of the European Research Area (ERA), HEIs have undergone through profound national policy alterations. Moreover, the internationalization has caused many changes to the academic activities. Several of the characteristics of HEIs that were affected are teaching, research, the academic institutional management and offered services [17]. The quality of the before mentioned aspects of HEIs has been vastly improved since the establishment of these rules.

3.1.3 Depicting collaborations within or between HEIs

There are several approaches used to capture the activities of researchers. Some of them are used for interlinking researchers and presenting their results in a wider audience, such as LinkedIn and ResearchGate, several others provide access to resources, like Google Scholar and Scopus, while other systems capture the overall activity of researchers within an academic department, within a specific scientific field, or at a greater scale. To elaborate, several networks for scientists are focused on the support of the scientific networking of a specific University, such as the Stanford Community Academic Profiles - CAP, the INDURE - Indiana Database of University Research Expertise and so on, some of them are created through research projects, like VOA^{3}R, and support the needs of a specific scientific field; a number of them are created by commercial organizations and are proprietary.

Several of the before mentioned technologies offer only the web interface for scientific networking, lacking in the support of the identification, presentation and analysis of collaborations. Some other alternatives do not offer interoperability, whereas others support only the dissemination of the scientific results, or the raw presentation of scientists' publications.

3.2 Ontology for the networking of researchers

VIVO is a part of the Linked Open Data movement. Among its main incentives is to make the institutional data of HEIs widely available, interoperable and extendable [12]. VIVO facilitates the storage of information related to research activities of the faculty members of an institution. It monitors research indicators, such as the publications in journals, conferences, or the publication of books, the collaborations between faculty members, the equipment of the academic institution and the related events that take place within an institution. VIVO is based on widely used ontologies: the *Bibontology*, the *Dublin Core Elements*, the *Dublin Core Terms*, the *Event Ontology*, the *Friend-Of-A-Friend (FOAF)*, the *Geopolitical*, the *Provenance support*, the *Research resources*, the *Scientific research*, the *Simple Knowledge Organization System (SKOS)* and two additional ontologies developed for VIVO, namely the *Vitro public ontology* and the *VIVO core*. The title, namespace and prefix of the VIVO related ontologies are described in Table 1.

Table 1. Namespaces used in VIVO

Ontology	Namespace	Prefix
Bibontology	http://purl.org/ontology/bibo/	bibo
Dublin Core elements	http://purl.org/dc/elements/1.1/	dcelem
Dublin Core terms	http://purl.org/dc/terms/	dcterms
Event Ontology	http://purl.org/NET/c4dm/event.owl#	event
FOAF	http://xmlns.com/foaf/0.1/	foaf
geopolitical.owl	http://aims.fao.org/aos/geopolitical.owl#	geo
Provenance support	http://vivoweb.org/ontology/provenancesupport#	pvs
Research Resources (eagle-i)	http://purl.obolibrary.org/obo/	ero
Scientific Research	http://vivoweb.org/ontology/scientificresearch#	scires
SKOS	http://www.w3.org/2004/02/skos/core#	skos
Vitro Public Ontology	http://vitro.mannlib.cornell.edu/ns/vitro/public#	vitropublic
VIVO core	http://vivoweb.org/ontology/core#	Vivo

4. THE AcademIS ONTOLOGY

The AcademIS (Academic Information Systems) ontology has been created in order to represent information about the research and educational activities as well as the academic collaborations within HEIs, as a whole. It builds upon the VIVO ontology, which is extended in order for educational activities and collaboration information to be included. To elaborate, the AcademIS ontology addresses the needs of the faculty, the researchers and of both graduate and undergraduate students, creating, storing and exploring academic activities and collaboration possibilities.

4.1 The AcademIS ontology

AcademIS is defined by means of a set of data elements, for each of which the following set of parameters are described by the AcademIS application profile:

- Element name: The element name indicates the name of the specific element in the AcademIS ontology.
- Value space: The value space of the element is the range of possible values that an element could have.
- Obligation: The obligation indicates if the appearance of the element is mandatory (M), recommended (R) or optional (O).
- Class: The class in which the element is applied.

4.2 Introducing and comparing AcademIS to VIVO

4.2.1 Reused components in the AcademIS ontology

The AcademIS ontology reuses and extends the VIVO ontology. VIVO is designed to incorporate all the research aspects of an institution, its personnel, the courses and events offered within an academic institution, as well as the research co-operations that take place. Thus, the components that have been reused in the AcademIS ontology are the following: *Person*, *Organization*, *Research*, *Event*, *Location*, *Course* and *Activity*. These components are important for the conceptualization of the research activities and collaborations within an academic unit.

In order to support the interoperability of the ontology, VIVO reuses widely known ontologies and its core ontology is quite detailed. On the other hand, it offers the localization of the ontology, by enabling the personalization of the fields of the ontology so as the needs of each HEI to be met [12,15].

As mentioned before, VIVO ontology's main focus is the research interactions and activities of the faculty members, so it provides thorough information on the courses and the events that happen in an academic department, the authorship and the co-authorship of the academics. However, it does not provide relevant information on the teaching collaboration networks that are formed within an academic institution, as well as on other teaching aspects that are useful for professors and students of HEIs.

4.2.2 Newly introduced components of the AcademIS ontology

The AcademIS extensions introduced in VIVO regard teaching collaborations, courses and courses relationship information, like prerequisites, proposed and completed thesis topics, scholarships, internships, etc. To elaborate, the classes that have been introduced by the AcademIS ontology are the following: *Teaching collaborations*, *Internships*, *Scholarships* and *Thesis*.

The developed extensions in the ontology are thoroughly presented in the Figure 1.

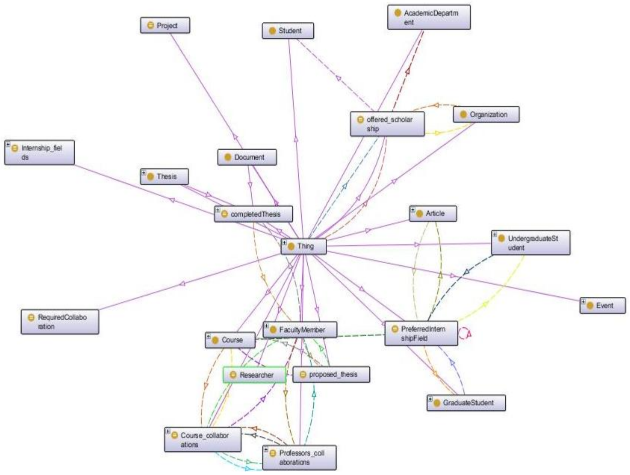

Figure 1. The newly introduced components of the AcademIS

The *Teaching collaborations* (Figure 2) display the collaborations between the professors in a specific academic department of the HEI. The subcategories of the teaching collaborations are the following: course collaborations, job positions and educational collaborations (Table 2).

Table 2. Teaching collaborations in AcademIS

Element name	**Obligation**	**Value Space**
Teaching collaboration		
Class: Course collaboration		
Name	M	Faculty member
Open job position	R	Job position
Assigned professor	R	Professors collaborations
Assigned laboratory professor	R	Professors collaborations
Webpage in department website	O	Webpage
Course’s webpage	O	Course
e-class webpage	O	e-class web page
Class: Available job positions		
Requested collaboration from	M	Faculty Member
Status	R	text
Course in which collaboration is requested	R	Course collaborations
Other people related to the job	O	Professors collaborations
Academic Background	R	Text
Prerequisite knowledge	R	Text
Work expirience needed	R	Text
Web page of the course	O	Text
Class: Educational collaborations		
Collaborators	M	Faculty Member
Job position related	M	Job position
Assigned course as a professor	R	Course collaborations
Assigned laboratory professor for course	R	Course collaborations
Web page of professor	O	Text

The course collaborations describe the collaborations of the professors in a specific course. The available job position describes the open job positions for the courses of the academic department. The educational collaborations express all the collaborations that correspond to courses. Thus, this extension includes information about the collaborators, the title of the course for which these collaborations take place, the open positions for collaborations.

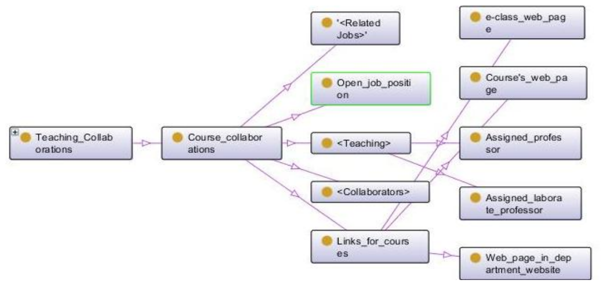

Figure 2. Teaching collaborations ontology

Another new aspect of this ontology is the field that represents *Internships* (Figure 3). There are two subcategories in the internships, the preferred internship fields and the proposed internships (Table 3).

Table 3. Internship in AcademIS

Element name	**Obligation**	**Value Space**
Internships		
Class: Preferred internship field of a student		
Name	M	Preferred internship field
Related Course	M	Course
Description	R	text
Affiliated field	O	Preferred internship field
Internship related research	O	Article
Desired internship field of undergraduate student	R	Undergraduate Student
Desired internship field of graduate student	R	Graduate Student
Class: Proposed internship by organization		
Name	M	Internship fields
Description	M	text
Affiliated field	R	Internship fields
Related proposed internship	O	Internship
Internship related research	O	Article

The preferred internship field examines the field that interests each undergraduate or graduate student that is looking for an internship. The proposed internships display all the relevant information for a specific internship position that is offered by an organization.

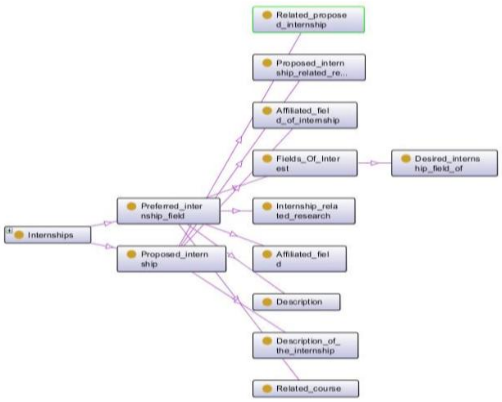

Figure 3. Internship ontology

Scholarships model information about all the scholarships of a specific department (Figure 4). This category has only one subcategory which is the offered scholarships. It examines the amount of the offered scholarship, as well as the duration, the prerequisites and the provider of the scholarship and the eligible students (Table 4).

Table 4. Scholarships in AcademIS

Element name	Obligation	Value Space
Scholarships		
Class: Offered scholarships		
Name	M	Scholarship
Prerequisites	R	text
Offering the amount of	R	text
Eligible student	R	Undergraduate Student
Duration of scholarship	R	text
Scholarship provider	M	Organization
Offered in	R	Academic Department

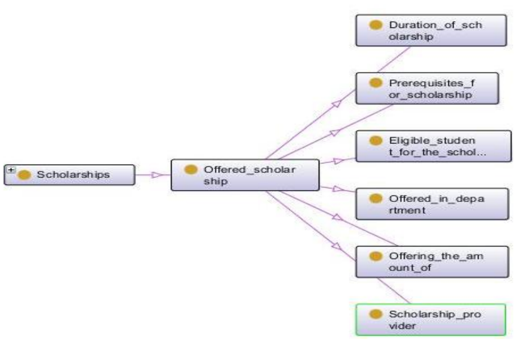

Figure 4. Scholarships ontology

Thesis expresses the necessary information about theses in the academic department (Figure 5). The subcategories are the following: completed thesis, proposed thesis and thesis fields. The thesis field displays all the relevant information of a specific thesis field. To be more precise, it connects a thesis field with possible instructors, possible interested students, related research and proposed thesis topics (Table 5).

Table 5. Thesis in AcademIS

Element name	Obligation	Value Space
Thesis		
Class: Completed thesis		
Name	M	Thesis
Supervisor professor	M	Faculty member
Field of proposed thesis	M	Thesis field
Class: Proposed thesis		
Description	M	Text
Status of proposed thesis	R	Text
Instructor	M	Faculty Member
Relevant course	O	Course
Field of proposed thesis	O	Thesis field
Prerequisites	R	Text
Class: Thesis field		
Name	M	Thesis field
Field related event	R	Event
Thesis related research	R	Article
Proposed thesis topics	M	Thesis
Related thesis fields	O	Thesis field
Desired thesis field of (Undergraduate Student)	R	Undergraduate Student
Desired thesis field of (Graduate Student)	R	Graduate Student
Possible thesis instructor	R	Faculty Member

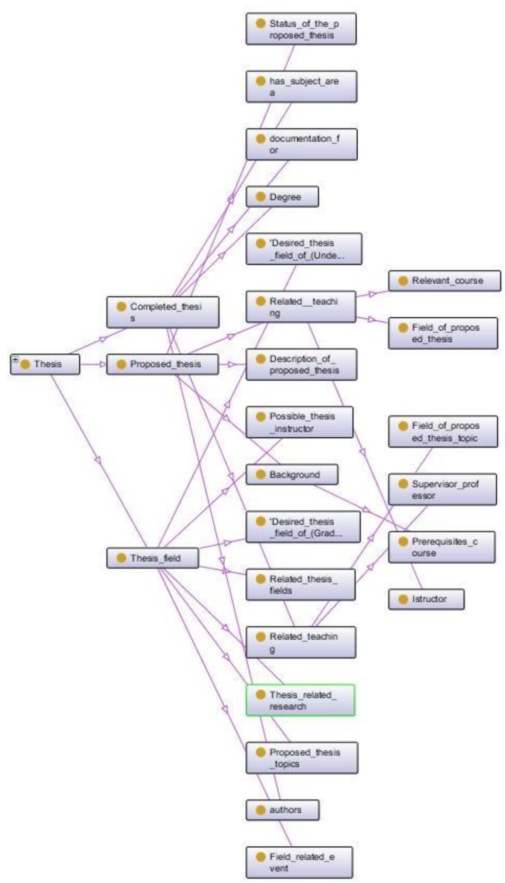

Figure 5. Thesis ontology

4.3 Case Study for an Academic Unit

In order to illustrate the significance and the proper use of the fields of the AcademIS ontology in a real case scenario, a case study of an academic department of a HEI is also included in this paper. In the presented case study, only the contents of the main fields of the ontology will be presented.

4.3.1 Overview of the case study

In the specific instance of the Technological Educational Institute (TEI) of Athens AcademIS ontology, the ontology is filled by using external databases of research information, such as Scopus, as well as information from the institution's digital library. In this section, a part of the instance developed with the use of AcademIS ontology is presented. To be more specific, in this instance there is a special focus on the Department of Informatics of TEI of Athens.

The amount of the departments is 1, due to the fact that the case study is developed especially for the academic activities within the TEI of Athens. The total amount of people depicts not only the people that work within the institution, but also the people with whom the academics of this specific HEI are cooperating.

Table 6. Contents of the case study based on AcademIS

Amount of departments	1
People	325
Activities	37
Courses	69
Events	289
Organizations	44
Equipment	1
Research	624
Locations	320
Scholarships	1
Internships	5
Thesis topics	12
Teaching collaborations	78

The activities may include services, certifications, agreements and contracts. The events that take place within an academic department include workshops, seminars and conferences, while the courses part of the curriculum of the specific academic department. The equipment includes all the hardware and special equipment within the academic institution, the locations describe the points of interest of a HEI, such as the auditoriums, the campuses and the buildings, whereas the field research contains information for all the scientific research that is conducted by the academics of an institution. The scholarships fields, internships, theses topics and teaching collaboration are the new categories added in the AcademIS ontology.

5. SERVICES FOR CAPTURING ACADEMIC ACTIVITY

5.1 Description of the IREMA case

IREMA (Institutional REsearch MAnagement) is the tool that has been set up in order to provide services for quality evaluation and monitoring of the academic activity. It is based on the AcademIS ontology in order to provide insights in both the research and education constituents of HEIs. IREMA addresses the need for capturing research and educational activities as well as faculty collaborations, a combination that is of vital importance. However, little work has been done to monitor the conjunction of both research and teaching in the academic departments of HEIs.

The IREMA is based on the research and teaching ontology described in this paper. The case study used for IREMA is built upon renowned sources, which will be mentioned in the following section. It constitutes of visualization tools and services for presentation and analysis of all the activities carried out in a HEI, while it also displays and examines the collaboration networks formed in a HEI in various ways, each time considering different parameters.

The target users of IREMA are the researchers and the academics of a HEI, as well as the faculty that is involved in the evaluation processes of the institution. Potential users of the IREMA services may include the students, due to the fact that their activities of interest are also facilitated by the ontology integrated into IREMA. Other potential users are the institution's researchers and the external researchers seeking collaboration. Moreover, organizations that provide internships, scholarships or grants can also be considered as future users of IREMA.

5.1.1 IREMA architecture

The IREMA is a system that is populated with information about publications and research activities. Moreover, the institutional research proceedings and publications information from Scopus are also data sources exploited by IREMA. Scopus exports publications in CSV format, which are subsequently imported to IREMA. As aforementioned, IREMA implements the AcademIS ontology with the use of Protégé in RDF/OWL format [18].

Among the functionalities of IREMA are the import, the manipulation and the presentation of the data. The first step of the process is the import of data from verified sources. The next step is to parse the data to the system and map it to the ontology elements. Next comes the decision making, followed by the optimization process and the presentation of the data through different kind of visualizations. Each of the visualizations produced by IREMA follows a different approach. IREMA also comprises prediction models, by means of which the probability of a choice within the specific sample can be presented to the user.

The actual services facilitated by the proposed solution include networking services for scientists, monitoring of the research and academic activities that take place in a HEI, evaluation and quality assurance of academic institutions, decision making support through data visualization and consultation services based on integrated prediction mechanisms.

5.1.2 IREMA visualizations

In IREMA several different approaches of data visualization are utilized. Some of the approaches display the entire scientific community within the HEI, the interactions among its members and the patterns of their collaborations. Other approaches examine the research relationships and similarities between specific academics, whereas there are also approaches that compare whole academic departments and the research activities that occur in them.

To elaborate, IREMA utilizes several graph metrics and related visualizations. Graph metrics include betweeness, degree centrality, closeness, eigenvector, clustering co-efficient, while implemented visualizations are common paths, co-authorship graph, parallel coordinator's graph and map of science. In the betweeness graph the authors that are acting as connecting points between the other users are displayed. Common paths display the co-publications of faculty members and their common scientific area. The participation at conferences is accounted in the graph. The co-authorship graph depicts all the connections between two professors and their common scientific areas.

5.2 Visualization tools and services

5.2.1 Common paths

The common paths display the common scientific information of the authors selected by the user. To elaborate, it presents the common scientific fields and the joint activities of the selected faculty members.

Source:Glotsos D.
Target:Paravatou-Petsotas M.
The shortest weighted path from is:[E3970, E4599, E3321, E4532, E2516].
The length of the path from: is: 5.
The nodes of that path are
0.From Glotsos D. To Ninos K.
1.From Ninos K. To Fountos G.
2.From Panayiotakis G. To Fountos G.
3.From Panayiotakis G. To Loudos G.
4.From Loudos G. To Paravatou-Petsotas M.

Figure 6. Common paths visualization

5.2.2 Parallel coordinator's graph

The parallel coordinator's graph displays the amount of publications and research projects of each academic, as well as the corresponding graph. Further focus can be applied in the parallel coordinators graph in order to get more specific results about the authors that have more publications, more journals or more research projects.

Figure 7. Parallel coordinator's graph

5.2.3 Map of science

The map of science presents the overall research activity of all the scientific fields within a HEI. To elaborate, each scientific field is proportionally displayed with respect to the publications that have been conducted by the professors of the HEI in this specific field. As a direct consequence, the user can observe which scientific domains have attracted more research activities.

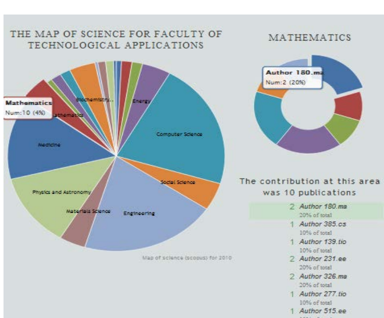

Figure 8. Map of science

5.2.4 Research concepts visualization

In the scientific concept visualization the scientific areas that interest each academic are displayed in a cloud of words. The before mentioned visualization refers to the scientific areas of interest in the context of research and teaching.

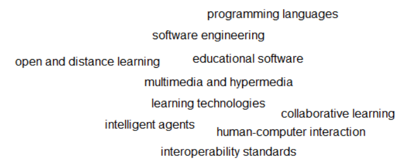

Figure 9. Scientific concept cloud

5.3 Collaboration networks

5.3.1 Researchers' collaboration networks

The researchers' collaboration networks present the collaborations that are formed between authors. This visualization can demonstrate different aspects of a collaboration network based on the selection of the user. The different graphs that can be produced in the context of the collaboration networks are the degree graph, the betweeness graph, the closeness graph, the eigenvector graph and the clustering co-efficient graph.

Figure 10. Collaboration networks of researchers

5.3.1.1 Degree Graph

In the degree graph visualization, all the professors that have been authors of scientific and research papers are displayed. In this representation there is a special focus on the collaboration relationships between the authors. More specifically, the authors are displayed in research communities along with their research collaborators and the most collaborative authors are highlighted in the center of each research community. The degree graph is a tool that can be utilized in order to perceive which authors are in the center of collaboration in an institution. Thus, the degree graph depicts the most active researchers in a HEI.

5.3.1.2 Betweeness Graph

The betweeness graph displays those researchers that act as connecting points between different clusters of researchers that otherwise would not have any direct connections. In this graph the researchers that link the different groups of researchers, acting as research hubs, are displayed in the center of the graphs.

5.3.1.3 Closeness Graph

Closeness is the measure of the speed of the dissemination of information from an author to all other authors in succession.

5.3.1.4 *Eigenvector Graph*

The eigenvector graph captures the significance of an author in a network. To elaborate, the importance of an author is based on the measurement of the score of the authors that belong to the same network. The authors with more connections contribute more to the author's score, than the authors with fewer connections.

5.3.1.5 *Clustering co-efficient Graph*

The clustering co-efficient graph of an author examines the likelihood of an author and the connected authors to be a group.

5.3.2 *Educational collaboration networks*

The educational collaboration network examines the teaching collaborations of a specific professor in the courses in which participates.

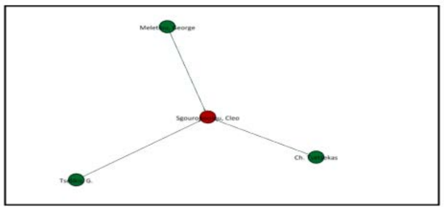

Figure 11. Collaboration networks of professors

6. CONCLUSION – FURTHER WORK

The presented solution introduces an ontology approach for modeling the research and educational activities within HEIs as well as the corresponding collaborations among academics. More specifically, it extends VIVO, a widely used ontology, so as to cover the teaching activities and connections of academics, and to facilitate the research networking in educational institutions. In addition, it presents interactive decision making tools and services building upon data visualization techniques, for the enhancement of the evaluation, quality assurance and strategic planning processes of institutions.

Further work falls under the perspective of the manipulation of the knowledge management in open linked data environments and data retrieval management for the creation and publishing of ontologies.

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