The First Romanian

Research Assessment Exercise

– RRAE –

Evaluation period: 2006 – 2010

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Einstein: "Not everything that counts can be measured, not everything that can be measured counts."

Contents

1. Introduction

It is widely recognized that the development of a society is determined essentially by the performance of its education system, the education level of citizens. The main resource of a nation is the creativity of its members and highly qualified human resource is a great wealth of it. Today not only decide the future of a country's natural riches, but in a largely intellectual capacity of the citizens put the value in the global production network. Higher education and scientific research are activities that ennoble souls, formed characters, generate cognitive strengths that manage this and anticipate the future. Without an efficient education without a solid and coherent education without intellectual elite, a society in danger of dying by suffocation, risk permanently losing contact with the civilized world in constant evolution.

Science and technology, although they had a spectacular evolution in the last 50 years have not yet provided robust responses to the challenges that call into question even the existence of human evolution. Pressure on scientists is the increasing viable solutions to major problems facing us.

Uneven development of mankind, limited access to education and unbalanced, science and culture in many parts of the world in general, and unequal access to resources, make difficult a comprehensive approach to human problems. Although globalization is inherent, ensuring global sustainable development is difficult.

It requires creating a more just and equitable world, including in particular through education, science and technology to which access must be configured with robust national and international policies.

The new knowledge-based society requires increasing the training of all members of society and direct involvement in the creation of goods and innovative products for development and self-regulation based on innovation and creative economies.

Find XXI century higher education system and scientific research in a real process of search and changes designed to meet the challenges of economy and knowledge-based society. Developed countries such as England, France, Germany, Japan, USA and others have already launched restructuring programs of higher education systems and research, some of which are in advanced stage of implementation, to meet the challenges of globalization, the company based knowledge and competitiveness. Excellence in universities and research entities is a key factor for increasing competitiveness and efficiency of resource allocation. The experience of countries like England, Germany, Spain, France, Japan and others highlights the importance of merit-based allocation of resources, impact on community development and innovative thinking and research on infrastructure recovery. There is an obvious need to differentiate universities and research entities in terms of performance and development strategy consistent with the mission assumed independent. Supporting schools and centers of excellence in the European context and networking excellence can be primary elements of a new policy on research and higher education.

Development of global innovation networks and their potential impact on performance knowledge-based economy is a key factor in the adoption of policies to facilitate the development of new innovative enterprises, developing a system of European patents, reducing barriers to mobility of researchers and competencies, reduce costs exchange of knowledge and technologies.

The analysis of recent research university status, resulting, inter alia, three important conclusions:

(I) chronic lack of predictability of public funding of research on short and medium term, only partially explained by the occurrence of recession and economic crisis after 2008;

(Ii) competitive distribution of most of the available funds on projects that can be considered, even for the most important academic, but with little strategic aggregation of results at national level;

(Iii) limited applicability of the results of university research, including innovations in the actual economic practices.

Among the many arguments and interpretations that support these conclusions, one is of immediate interest and calls for swift implementation of policies and improvement: some areas of academic research, in fact the most important risk facing major reduction in their growth potential, which both have negative effects on the quality of academic training of future specialists and on other areas of research, especially on national development potential. We risk becoming dependent on knowledge and technology import performance in an even greater extent than at present, with huge economic costs on short and medium term, recognizes the chronic vulnerability of key areas of academic research and does not initiate measures urgent improvement to enhance their research performance.

Within the knowledge triangle education-research-innovation, universities play a vital role by generating new knowledge, highly skilled human resources through training, transfer and diffusion of knowledge for socio-economic environment. Thus, universities must be analyzed in terms of education, society, R & D and innovation, sustainable impact on the results of the knowledge economy.

Knowledge Triangle will be the strength of Europe 2020 strategy to achieve the desired level of global competitiveness. The new strategy aimed at increasing investment in knowledge generation in parallel with the intensification of their dissemination and absorption of tangible applications. It is necessary to support basic research and advanced technology, impact on the development of knowledge-based economy and society.

In this particular context, we must admit that the problem is not just an adaptation of universities and research to meet the current crisis. Such a position would be based on an ethos of passivity, of waiting for a possible turnaround, which would produce by it and outside the universities, then to pass them positive. Council of RAM as, by contrast, universities and academic research, especially now faced with an acute need for re-affirmation of the potential they have. One such potential exists, was activated often in difficult times of history and proved to be the most important tool reconfiguration and confidence to overcome difficulties. Now is the moment again to reaffirm the potential tulle. Indeed, in dealing with crisis, universities are

best positioned to be invested in building confidence and the possibility of fulfilling the hopes of overcoming the difficulties. This is because universities, the research undertaken, expanding the horizons of knowledge and innovation, through their training programs, human capital forms the young, the transmission of knowledge in society and by working directly or indirectly, the economic companies, help development capita intellectual industrial productivity growth, the establishment of new enterprises, the culture they represent and transmit universities are critical awareness of democracy and creation of tradition, innovation and diversity.

In this context, the training of human resources it needs to be rethought and oriented towards the development of new competencies and skills that enable the change as an opportunity to open to new ideas in cultural diversity in the new knowledge-based society, precursor of a future society of conscience.

Creativity and ability to innovate are key human qualities that we use in various situations and places. By promoting human talents and ability to innovate, create new products to effectively exploit these qualities, it can ensure the competitiveness of knowledge-based society and economy.

Increasing innovative capacity, recovery capacity of teachers and students creative transfer of knowledge, products and technologies in the economic environment is one of the determinants of socio-economic mission of universities.

Universities, by specific functions undertaken in society, are called to develop programs-oriented scientific research and new directions in science priorities, manage collection schools of excellence for research and optimizing resources through advanced knowledge management and resources.

University which is envisaged for this millennium will certainly be innovation institution, with strong creative facets, anchored dynamic evolution of society and economy. Scientific research is part of the university mission, at least the great universities, being necessary to complement the learning process, but also one of the main axes connecting blades universities in society requirements.

Connecting science to society, the economy should increase the role of universities both in human resources training and direct involvement in the transfer of knowledge, innovative products and technologies to the economic environment.

Universities should be funded more for what they do than for what they are directing funding on relevant outputs and not inputs. Competitive funding should be based on the institutional system of performance indicators evaluates and internationally calibrated values. Successful companies are those that can exploit knowledge effectively in order to increase competitiveness and performance, attract the workforce, new businesses and investors. Universities play a crucial role in research and innovation ecosystem producing human capital through education, attracting highly qualified human resources and investments, actively involving local and regional communities through knowledge and technology transfer and supporting global competitiveness of nations and regions. The status, quality and productivity of higher education are an indicator of strategic objectives and global competitiveness.

Universities play an essential role in the process of creating a knowledge-based society and economy and competitiveness. In this context, universities are in an intense competition for resources, students and prestige.
Attention is focused increasingly on the mechanisms of evaluation and calibration of quality and performance of teaching and research. Evaluation research can play an important role in improving performance and quality, in support of autonomy and strategic planning, research assignments and differentiation of human resource attraction. For a more rigorous and consistent evaluation of research in universities requires a multidimensional approach that combines qualitative with quantitative methodologies.

2. RRAE Objectives

Starting with the **objectives of evaluation process**, as:

- Improvement of research
- Improvement of quality research
- Directing research centers to excellence
- Provide a higher level of information to students and the general public
- Development of tools to inform policy makers
- Creating a transparent environment for taxpayers and the general public

and based on **principles of the evaluation process**:

- Aggregation of quantitative indicators of the quality;
- Recognize the differences between fields of research;
- Including the impact and benefits of research;
- Integration of self-assessment results;
- Transparency and robustness assessment methodologies.

Identifying the needs of a comprehensive national assessment was fulfilled by preparing a national assessment exercise for the Romanian universities. It was clear the necessity of establishing the goals of the assessment exercise:

- Creating a sustainable environment for research in the areas of quality assessment;
- Establishing a relevant number of criteria and indicators of quality in scientific research performance evaluation for each area;
- Identifying clusters relevant cognitive performance in scientific research;
- Qualitative and quantitative evaluation by a peer-review process.
- Involving a large number of foreign experts in the evaluation process
- Creating a platform for supporting performance in editing editorial relevant magazines in Romania.
- Creating a software platform for the exchange of knowledge between researchers

- Identifying relevant existing research infrastructure in universities.
- Developing a methodology for identifying and supporting the University of Excellence program in Romania.
- Developing the Research Assessment Support SISEC
- Organizing a system of scientific authorship for young PhD.

3. About RRAE

3.1 Organizing RRAE

3.1.1 International experience

Romanian Research Assessment Exercise (RRAE) has included a thoughtful analysis of the current assessment exercises that were implemented in countries with an international recognized R&D portfolio.

An important rol in increasing the competitiveness of European universities is played by the expansion and diversification of the European competitions in the scientific research landscape by:

- financing research projects based on performance scoring;
- linking public funded research projects with socio-economic requirements;
- extending competition to the private research institutions

Research assessment and identifying the centers of excellence are vital to define the mechanisms and strategies for research quality improvement.

Scientific research performance in Europe in latest year has been out taken by the U.S. and Japan results. In order to overcome the present situation, Europe need to implement a better exploitation of research results in the socio-economic environment. Nowadays, Europe needs:

- a strong fundamental research;
- an industry with the ability to exploit scientific output and ensure competitiveness;
- a space for an effective interaction between these two.

The present analysis has identified four types of assessments:

I. Evaluation of projects for funding.

The assessment is performed by panels of experts, the output of researchers involved being analyzed selectively and only relevant insofar as the proposed research topic. These evaluations assess the correlation of the research plan with researchers experience and

resources and broad impact of research. Examples: evaluation of the National Science Foundation and Japan Society for the Promotion of Science.

II. University assessment based on research domains

These evaluations are made regularly on different research areas, to co-finance public funded research. They include a significant part of the university research output, the process being implemented by either scientometric tools or panels of experts based on very precise set of criteria and indicators. This set of criteria is based on the impact of both the quality and the impact of the research environment, and the infrastructure dynamics. Examples: Research Assessment Exercise, Research Exellence Framework, Research Quality Framework, Performance Based Research Funds.

III. University ranking

Universities ranking is based on the quality and impact of research, being usually made by using scientometric criteria on the research output. Indicators usually include the number of articles published, the journal's impact factor in which they were published, the number of citations, Hirsch factor of authors and other bibliometric metrics. Examples: Jiao Tong University evaluations, Academic Ranking of World Universities - Shanghai, independent study on universities in Taiwan, Taiwan 2008 Performance Ranking of Scientific Papers for World Universities.

IV. Research assessment as support of teaching

The evaluation of educational universities is based on the following criteria: the mission of the institution, the design of the educational program and courses, scientific output and continuous learning. Example: Finnish Higher Education Evaluation Council.

During the evaluation processes the following criteria has been identified:

a) **National Competitive Grants** – e.g. research funds obtained in national competitions for research projects;
b) **International Competitive Grants** – e.g. research funds obtained in national competitions for research projects;
c) **Funds from national research services** – e.g. consulting services, technical and technology services, socio-economic partnerships, artistic events, spin-offs, marketing output of research / artistic creation;
d) **Funds from international research services** – e.g. consulting services, technical and technology services, socio-economic partnerships, artistic events, spin-offs, marketing output of research / artistic creation;
e) **Higher Education activities** – e.g. the percentage of professors coordinating BSc, Master and Phd thesis;

f) **Performance in Higher Education** – e.g. percentage of students completing BSc, Master and PhD thesis, results of the students in scientific research / creative activities;
g) **Academic Recognition** – e.g. national and international awards, invitations to conferences, visiting professor positions, chair in international events, leadership positions in professional organizations;
h) **Scientific Research Impact** – e.g. citations and published reviews;
i) **National Scientific Output** – e.g. published articles, books, patents, art works – national level;
j) **International Scientific Output** – e.g. published articles, books, patents, art works – international level;
k) **Innovative Output** – e.g. works and patents that have direct economic and social impact;
l) **University Research Infrastructure** – e.g. research infrastructure, laboratories, libraries and scientific debases;
m) **Scientific Environment** – e.g. academic staff training process, reintegration programs after long absence (post-natal leave), networking, active Nobel Prizes, in university, support for scientific events, mobility programs.
n) **Strategic Planning** – e.g. defining priority domains supported from university funds.

Based on our previous analysis, the following matrix presents specific criteria for different national research assessment exercise. The following abbreviations are the standard ones, RDE meaning "Research and Development Evaluation". IC6 Quality Standard, HG 551/2007 is evaluation mechanism employed by the Romanian scientific environment, prior to this exercise.

Table 1. Evaluation criteria employed in the major international assessment exercises.

	IC6 RO	HG 551 RO	RAE UK	REF UK	EI DE	RDE FR	RDE CZ	RDE NL	RDE DK	RDE Sweden	EUE Finland	RDE USA	RDE Japan	RQF Australia	PBRF New Zeeland	RDE Taiwan	PRSP WU Taiwa
National Competitive Grants	X	X	X			X	X	X	X					X	X		
International Competitive Grants	X	X	X		X	X	X	X	X					X	X		
Funds from national research services	X	X	X			X	X	X	X						X		
Funds from international research services	X	X	X			X	X	X	X						X		
Higher Education activities	X	X	X			X		X			X				X		
Performance in Higher Education			X			X		X			X			X	X		
Academic Recognition		X	X			X		X		X		X		X	X		
Scientific Research Impact	X	X		X	X	X		X	X	X		X		X	X	X	X
National Scientific Output	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X
International Scientific Output	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Innovative Output	X	X				X	X	X	X	X		X	X	X		X	X
University Research Infrastructure		X				X				X	X	X		X			
Scientific Environment		X	X		X	X	X	X	X	X	X	X			X		
Strategic Planning						X	X										
Evaluation type	**I**	**I**	**II**	**II**	**II**	**II**	**II**	**II**	**II**	**I**	**IV**	**I**	**I**	**II**	**II**	**III**	**III**

3.2 RRAE Methodology

The development of the evaluation methodology of the scientific reasearch and artistic creation'quality from the Romanian universities, which is a base for the ROMANIAN RESEARCH ASSESSMENT EXERCISE was achieved between December 2008 and April 2010.

As was previously mentioned, RRAE's goal is the classification, on specialty domains of the Romanian universities, according to the performances obtained in research and artistic creation, in order to improve the way of allocating the financial resources and to grow the competitional capacity of these- at the national and international level.

The general methodology of evaluation was elaborated by the Romanian experts panel (P0) together with the management team of the project, after a comparative analysis of the national and international practice from the domain, between December 2008 and October 2009.

At the same time, the specific methodologies, detailed presented in the six specific guides of evaluation, were elaborated between December 2009 and April 2010 and presented into academic community between May and September 2010.

3.3 Assessment Phases

The first steps of the methodological approach were consisted in the elaboration of the reference terms of the evaluation exercise on the basis of the national and international experience from the domain, in the settle of the composition of the central panel of Romanian experts (P0) and in the establishing of The International Coordination Committee.

On the basis of the comparative analysis of the national and international practice in the research's evaluation were settled four general criteria of evaluation (and the associated average weights), their respective desriptors and the maximum number of accepted indicators for each criterion.

Afterwards were settled the forty two evaluation domains, structured on six groups. After the elaboration of the taxonomy of the universe of the domains subjected to evaluation, the four criteria were debated in more workshops, where a significant number of representatives from the universitary background from Romania were consulted.

Together with the forty two specialty domains, the methodology was presented at the international conference which took place on the 23-rd of October, in Aula Magna of the Academy for Economic Sciences from Bucharest. Over one hundred representatives of the Romanian universities and members of the International Committee of Coordination took part at the conference.

3.4 Research domains ascertainment

Specialty fields' taxonomy is a fundamental component of all the evaluation exercises. The classification is destined to offer a referential frame to the exercise, revealing affinities and kindreds between fields which must be consistently treated by the evaluators.

So, the members of the Romanian experts central panel (P0 panel, you can see ANNEX II) chose forty two specialty fields, as these totally reflect the major guide lines of scientific research and artistic creation from the universities from Romania.

The list of the evaluation fields was done starting, initially, from the thirty-seven doctoral fields of the National Council for Attestation of the Universitary Titles, Diplomas and Certificates (NCAUTDC) refined afterwards, by the project's management team and by P0 panel, by the comparative analysis of the fifty seven specialty fields, identified by NURC, in 2003.

As a consequence of this analysis, were selected the evaluation fields, used in RRAE. The fields were validated firstly by the NURC members, in the Extended Executive Board, from 16-th of October, being approved afterwards by the members of the Academic community, in the Public Event of Validating the Methodology, from the 23-rd of October, 2009. Similar to the evaluation methodology, used in the *Research Assessment Exercise*, from The United Kingdom, the research fields were divided in six thematic groups, being appointed a coordinator for each group of fields.

3.5 Completion of the general evaluation methodology

3.6 General methodology validation within the scientific community

Starting from the comparative analysis of the international practices from the domain, the management team of the project and P0 panel settled four general criteria of evaluation, having specific average weights:

I. The results obtained in the activity of scientific research/artistic creation – 60-70%;
II. The background of scientific research/ artistic creation – 10-30%;
III. The prestige in the academic community – 5-15%;
IV. Financial resources brought for the scientific research/ artistic creation – 5-10%.

Taking into account the particularities of the evaluation domains it was established that these criteria not to have a fix and an equal weight, in order to assure the equality of chances for the evaluated domains. The weight of minimum 60% given to the scientific production /artistic creation is due to the importance of this criterion in all the analyzed evaluation exercises.

Afterwards a preliminary list of the descriptors for each criterion was settled and the maximum number of indicators taken into account for each criterion was mentioned.

The evaluation criteria and the set of their respective descriptors were validated in some workshops organized in the universities from Bucharest, Iași, Cluj and Timișoara between April-September 2009.

3.7 Scientific expert panel selection

For the selection of the Romanian evaluators who participate to RRAE, was created an electronic platform of nomination/co-nomination, on specialty domains, in the project, hosted at http://conominare.ecs-univ.ro/. This process took place in July-October 2009.

By this platform the members of the Romanian scientific community could propose important personalities of the scientific research and artistic creation, in order to bring them in the assessment domain.

For each domain, the management team selected a number of evaluators who received the invitation to take part at the nomination/co-nomination process, and then, after the registering on the platform, they could be able to propose, in their turn, other evaluators.

The final list of the Romanian evaluators who participate to RRAE was settled by the management team of the project together with The National Committee for Coordination, the coordinators of the forty two evaluation's domains, after the analyzing the CV-s of all the experts who were registered on the nomination/co-nomination platform.

The nominal lists and the CV-s of the selected experts were published between 12-th of April and 21-st of May. The national scientific community could make appreciation on the proposed evaluators through this exercise. The final lists were established after these consultations.

The foreign evaluators who will be invited in RRAE were also settled by the management team of the project, taking into account the recommendations received from The International Coordination Committee and also the lists of experts used by the *European Science Foundation (ESF)* and *Research Assessment Exercise (RAE),* from the United Kingdom.

3.8 Domain specific methodology development

The list of the descriptors was finished by the members of P0 panel, the members of the International Commitee for Coordination and by the team management of the project.

CRITERIA	DESCRIPTORS
I. The results obtained in the activity of scientific research/artistic creation **(60 – 70 %)** **Maximum 3 indicators**	▪ Articles: • Publications rated *Web of Science;* • Magazines from international data base. ▪ Scientific books of author ▪ Patents ▪ Other achievements subjected to the author's right law and to the auxilliary rights, which imply the creation as a process of research and innovation in architecture and arts domains ▪ Products and/or innovative services with an economic impact which can be proved ▪ PhD advisers

II. The background of scientific research/ artistic creation **(10 – 30 %)** **Maximum 4 indicators**	▪ The organising of scientific events and artistic creation of international level ▪ The existence of some proper mechanisms for bringing of the young researchers ▪ The financial support of the university for the research in the prioritary assumed domains, by strategies at a national level ▪ Investments programme for laboratories/workshops, which are equipped with an infrastructure specific to the scientific research/artistic creation ▪ The capacity of the university to assure the acces to the specialty literature
III. The prestige in the academic community **(5 – 15 %)** **Maximum 3 indicators**	▪ Papers invited to the famous international conferences ▪ Visiting professor at the famous universities ▪ Leadership positions in international professional organisations ▪ Translations of proper scientific contributions, published by publishing houses from abroad ▪ Quotations and reviews of the author's creation ▪ Member of Romanian Academy, of the specialty academies of the academies from abroad ▪ Member in the *boards* of some magazines which are rated *Web of Science*
IV. Financial resources brought for the scientific research/ artistic creation **(5 – 10 %)** **1 indicator**	▪ Funds brought for the research: • by national competitions; • by internațional competitions; • by direct contracts with third persons; ▪ Funds brought from services/innovative/creative products

The quantification of the discussed descriptors is done by a set of formula elaborated by the management team of the project and by the coordinators of the forty two specialty domains, on the basis of the national and international experience in the research evaluation. The indicators resulted this way contain two different levels of evaluation, a quantitative and a qualitative one. The quantitative evaluation is realized automatically by the informatics platform, on the basis of the information contained in the assessment file, while the qualitative one is realized by the evaluating experts on the basis of the analyzed documents.

The evaluation of the respective files of a certain domain is done as it follows: the universities' files are evaluated on each criterion. To each criterion is allocated a maximum number of points (settled by the panels, on domains' groups, according to the table bellow).

The maximum score on a certain criterion will be given to the file which obtained the best result according to the evaluation formula/grid. The other files receive a score proportional to the obtained result. The total score of a file is calculated by adding the scores obtained to the four criteria.

	PGD I	**PGD II**	**PGD III**	**PGD IV**	**PGD V**	**PGD VI**
Criterion I	70 points	65 points	60 points	60 points	60 points	60 points
Criterion II	10 points	20 points	15 points	15 points	30 points	20 points
Criterion III	10 points	5 points	15 points	15 points	5 points	10 points
Criterion IV	10 points	10 points	10 points	10 points	5 points	10 points

3.9 Research Assessment Exercise Calibration – Piloting Project

The pilot assessment exercise covered 26 of the 42 assessment domains from 8 universities

A pilot assessment platform was developed internally starting from the specific assessment methodologies

The data used in the pilot assessment exercise have not been validated automatically (e.g., through searches in the Master Journal List and the database of the National Library)

All data introduced in the pilot assessment platform will be transferred to the Assessment Platform (SISEC) and validated automatically

Components of the pilot assessment exercise	**Persons in charge**
Developing the pilot assessment platform	IT team of the project
Introducing data on the assessment platform	Representatives of assessed universities
Quantitative evaluation	Management team (based on the reports generated by the pilot assessment platform)
Qualitative evaluation	Teams of experts

3.10 Data introduced on the pilot assessment platform

1st Criterion	
Articles in ISI journals/journal indexed in international databases	4445/1359
Patents	117
Books and book chapters in national/international publishing houses	1765/234
Outputs subject to intellectual rights	60
Products with socio-economic impact	0
2nd Criterion	
Doctoral advisors	207
Organizing scientific and artistic gatherings	418
Programs for attracting your researchers	71
Investments programs in laboratories	259
Access to scientific literature (number of subscriptions)	66
Edited volumes	332
3rd Criterion	
Invitated papers and talks	1537
Invited professorships	249
Citations	9489
Memberships in the Romanian Academy, Academy of Technical Sciences, and other national academies	58
Memberships in the editorial board of international journals, referees of prestigious publishing houses, memberships in the board of well-known professional organizations	548
National and international academic awards	271
4th Criterion	
Number of contracts	1756
Attracted sums through national/international contracts (in RON)	68.677.667.377/ 209.383.201

3.11 Issues of the pilot assessment exercise

- The data needed for the 2nd and the 3rd criterion (e.g., for doctoral advisers, research infrastructure and peer recognition) was badly structured, therefore information for these two criteria was sparse and a complete qualitative evaluation has not been done
  - ✓ *The management team has restructured the metadata for the 2nd and the 3rd criterion*
  - ✓ The quality levels used in the qualitative component of the assessment exercise have to be clarified. Evaluators have asked that this is done through the addition of quantitative elements (e.g., in order for an article subject to

qualitative evaluation to be considered of international level it should be published in a journal with an impact factor higher than a given threshold)

- ✓ *The final decision rests with the assessment panels; the management team will not impose quantitative landmarks on the qualitative component of the assessment*
- ✓ Selecting the scientific output subject to qualitative evaluation has been much discussed. A 10% quota has been decided upon and there are two options for achieving this
    - The coordinators of assessment domains select the elements of the scientific output that will undergo the qualitative evaluation – *implemented in the pilot exercise*
    - Each researcher selects 10% (but not less than one element) of her/his scientific output – *will be implemented in the assessment exercise*

In the pilot exercise the coordinators of assessment domains selected more than 10% and we had to randomly discard elements of scientific output to reach the desired quota.

3.12 Pilot assessment exercise – Experts suggestions

- ❑ The qualitative component of the assessment exercise should have a stronger impact of the final result by allowing the quality factor to have a wider range. At the moment it is between 0.7 and 1.2
    - 0,7 – local level
    - 0.9 – national level
    - 1 – international level
    - 1.2 – top international level
- ❑ It publication language of articles and books should influence strongly the qualitative components. It was proposed that articles and books published in languages that have a low geographical coverage should not be considered of "international" and "top international" level
- ❑ It was suggested that the "local" level should be discarded for descriptors such as "Doctoral advisors" and "Books" as both the ministerial order allowing doctoral supervision and the regulations for publishing houses are national

- The qualitative evaluation of research infrastructure should be done based on the invested funds

3.13 Methodology fine-tuning and result integration
3.14 Scoring formulas
3.15 Assessment guide books development

Elaborarea ghidurilor de evaluare Documente 42 – Ghidurile de evaluare

4. SISEC – Support system for research assessment

4.1 SISEC Objectives

Introduced as the first research oriented online software application, SISEC has been the main digital tool for the Romanian Research Assessment Exercise and had top level priority in the project evolution. The development started in January 2011, with a team of 12 people, having a first production version after nearly 8 months of effort. After the project deadline, the application continued to be developed and required several major updates in order to continue serving its goals.

From the beginning, the purpose of the evaluation research support system has been to serve as a central repository for saving and processing research data at national level. The system had to provide detailed insights over the research activity of individuals, departments, institutions and even national research areas, acting as a decision support system for the ministry of education and other policy makers.

In order to offer a global overview, SISEC was gathering and assembling data from various institutions, sources, or people, collected gradually and integrated after a specific set of rules, part of the general assessment methodology The system had to become a unique point of data entry, certifying the collected information and implementing multiple levels of validation, automatic and manual, at the user and institution level.

For its public area, the system will gather all individual data, in order to create a researcher profile, with all dimensions of an individual activity; it had to provide a real time Curriculum Vitae for any subject entitled to such information. Also, in order to support cooperation between research groups and institutions, SISEC included a research infrastructure service, where anyone could host labs and equipment information that would be shared with others on partnership grounds.

The assessment module had to implement specific methodologies for data selection, perform aggregation of recorded indicators and rank each institution on several evaluation criteria. Its reporting module had to be capable answering any type of questions regarding Romanian research activity, with real time indicators or synthetic historical data.

Finally, the database platform will be generating all kinds of reports that are currently required by universities and ministry agencies, with the role of coordination in research and education. This way, SISEC will provide a single point of data entry and cover multiple forms of reporting and information system research.

4.2 System Architecture

Being a national platform for research data integration and reporting, SISEC had to answer a large set of requirements from the users and administrator point of view. Availability and performance were the most important aspects of the design, but scalability and maintenance costs were revealed as key points in the further use of the system. During the analysis phase, the project team has accepted the following requirements for the core design of the system:

- Usage: over 30.000 researchers from all over the country;
- Concurrent users: 300 researchers and university administrative personal;
- Response times: fast loading times, with a maximum of 8 seconds/page;
- interface: online interface, client-server structure being much more inefficient because of the variety of client platforms (operating systems, running virtual machines and installments issues);
- Scalability: the system is fully scalable, to accept hot resources addition;
- Availability: high availability, with 24/7 services uptime.

In order to implement all of the above, an ORACLE package of web, application and databases platforms has been selected. The technology used for web and application layers was a Java EE application server: WebLogic Enterprise Application Server and the selected database suite was Oracle 10g for grid capabilities.

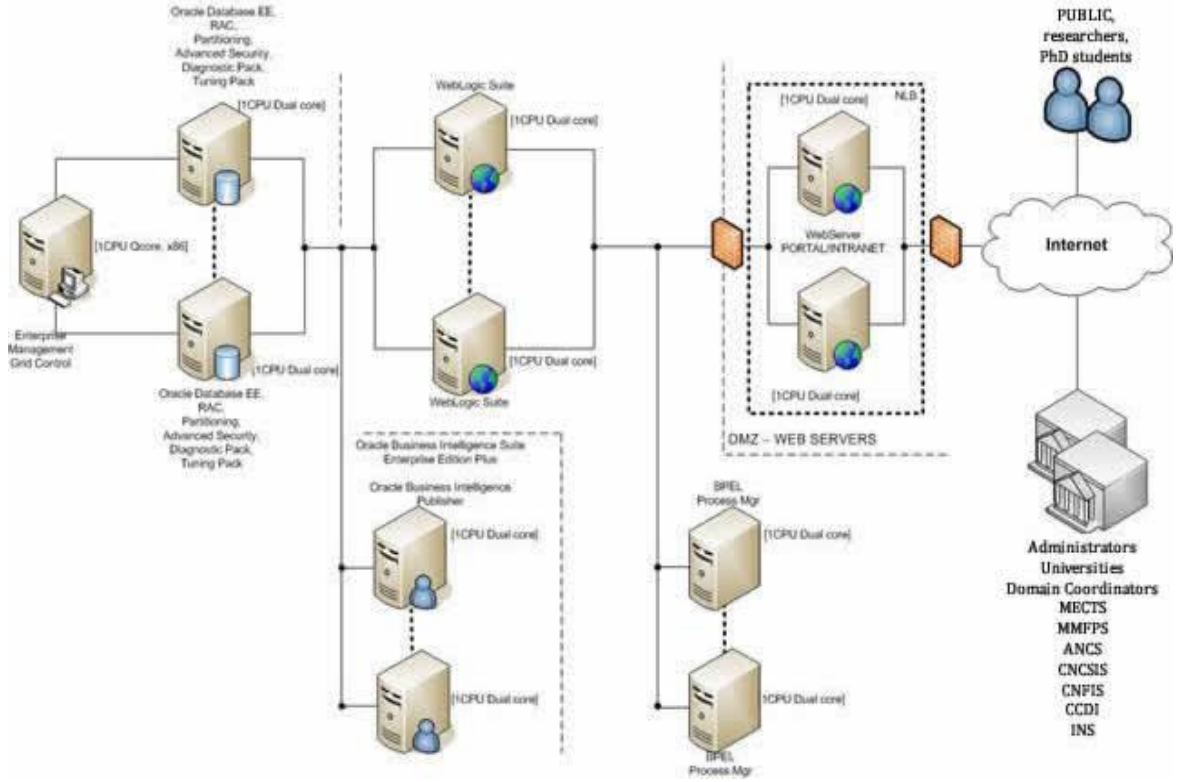

Figure 1. SISEC Hardware Architecture

4.2.1 Data Interface

SISEC data interface has been designed to accept multiple sources of information on different data levels and at certain workflow stages:

- Direct manual user input;
- University databases;
- Publishers databases;
- Bibliometric data providers;
- Other research content management systems.

4.2.1.1 University databases interface

Starting from 1999, after the university financing system has implemented the Bologna Process directives, several quality indicators were introduced for research evaluation. In order to be capable to support the fast growing data reporting requirements, universities have built in-house platforms for data collecting and reporting; they gathered data from all university employees and had a various output depending on client demands. This way, the data has been already harvested in local repositories, being available for queries through a general interface.

The design of the system presented two solutions for university database integration:

- Web-services for data uploading, so that each university could periodically upload data. This 24/7 service facilitates automated data interchange between the two systems (e.g. when a researcher uploads a document, it can be immediately synchronized on both servers), the only downside being the integration effort need from the university IT department;
- Manual import: after running a questionnaire with the universities IT responsibles, the need for a manual import service was obvious; universities have used a free or low-priced technology for their systems and were not always capable to connect to the web-service. Their preference was linked to the implemented technology, so SISEC has permitted the upload of XLS files for the platform's administrator.

4.2.1.2 Libraries and Publishers data integration

The research data included in the evaluation process has been organized by the

- Thomson Reuters – Web of Knowledge
- Elsevier – Scopus
- PubMed

Books

- National Library

Patents

- European Patens Office (EUPO)
- United States Patents Office (USPO)
- Romanian Patents Office (OSIM)

4.2.1.3 Bibliometrical evaluation

4.2.1.4 Data cleaning

Unicitatea datelor introduse in platforma Sisec se bazeaza pe cateva standarde recunoscute la nivel international si preluate de la instituii importante (Biblioteca National – MARK, Dublin Core).

4.2.1.5 Assisted user input

Researchers ID

Selectia datelor, auto-sugestion, ...

4.2.2 Data validation

4.2.3 Assessment

4.2.4 Reporting

4.3 SCIPIO – Romanian Editorial Platform

5. Expert Assessment Panels

Project co-financed through European Social Fund by Sectoral Operational Programme Human Resources Development 2007-2013

6. Romanian Research Assessment Exercise Results

6.1 Mathematics
6.2 Informatics
6.3 Physics

Conclusions

- RRAE is based on wide consultation with the academic community.
- Combine quantitative and qualitative indicators balanced calling a peer-review.
- Is based on performance indicators differentiation depending on the specific areas of science
- RRAE is the transparent process of peer-review involving a large number of foreign experts
- Consider self-assessment results and include analysis of the impact and benefits of scientific research.
- RRAE provides policy makers a tool for analysis and forecast targeting sustainable results of scientific research in higher education.
- RRAE will enable the cognitive clusters of excellence and Universities of Excellence program launched in Romania.

Appendix 1 – Scientific Domains

Group I 1. Mathematics 2. Informatics 3. Physics 4. Chemistry 5. Geology and geography **Group II** 6. Civil engineering and installations 7. Mechanical engineering and mechatronics 8. Aerospatial engineering 9. Transportation 10. Chemical engineering 11. Materials science 12. Oil, gas and mines 13. Industrial engineering 14. Electrical engineering 15. Energetics 16. Electronics and telecommunications 17. System engineering 18. Computers and information technology 19.Biotechnologies, food security and engineering 20. Environmental sciences **Group III** 21. Law and administrative sciences 22. Economic sciences 23. Military sciences, security and information 24. Political sciences and international relations 25. Communication and media 26. Sociology, anthropology and social assistance 27. Psychology 28. Education science 29. Sports	**Group IV** 30. Philosophy 31. History 32. Theology and religious studies 33. Philology **Group V** 34. Cinematography and performing arts 35. Music 36. Visual arts 37. Architecture and urbanism **Group VI** 38. Biology 39. Agriculture and forestry 40. Veterinary medicine and zootechny 41. Medicine 42. Pharmaceutical sciences

Appendix 2 – Evaluation Criteria

Appendix 3 – Project Team

1. Prof. Dr. Eng. Ioan DUMITRACH – Project Director
2. Prof. Dr. Eng. Gheogre Cata-Danil – Deputy Director
3. Marlena ROTAR – Project Secretary
4. Prof. Dr. Eng. Dragos CIUPARU – WP2 Coordinator
5. Prof. Dr. Eng. Serban AGACHI – WP3 Coordinator
6. Eng. Sorin AVRAM – WP4 Coordinator
7. Prof. Dr. Eng. Horia IOVU – WP5 Coordinator
8.