ROMANIAN KNOWLEDGE TRANSFER NETWORK IN NUCLEAR PHYSICS AND ENGINEERING – REFIN

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According to the requirements of the Romanian Nuclear Programme regarding the education and training of the skilled personnel for the nuclear facilities, a knowledge transfer network named REFIN (in Romanian: Retea Educationala in Fizica si Ingineria Nucleara) was developed since 2005. The knowledge target field is nuclear physics and engineering. The main objective of this network is to develop an effective, flexible and modern educational system in the nuclear physics and engineering area, which could meet the requirements of all the known types of nuclear facility and therewith be redundant with the perspectives of the European Research Area (FP7, EURATOM).

A global strategy was proposed in order to harmonize the curricula between the network faculties, to implement pilot modern teaching programs (courses/ modules), to introduce advanced learning methods (as Systematic Approach to Training, e-learning and distance-learning), to strengthen and better use of existing research infrastructure of the research institutes in network.

The education and training strategy is divided into several topics: university engineering, master, post-graduate, Ph.D. degree, post-doctor's degree, training for industry, improvement. For the first time in our country, it is used a modular scheme which allow staff with different technical background to participate at different levels. In this respect, the European system with transferable credits (ECTS) is used.

Based on this strategy were organized courses of "Radioactive Waste Management" and "Numerical and Experimental Methods in Reactor Physics" for both MS students and for industry. This way the training activity which a student attends will allow him or her to be involved, depending on specific professional requests, into a flexible educational scheme. This scheme will ensure competence enhancement and also the possibility of qualification development and a better mobility on the labour market. This kind of activity is already in progress at the Institute for Nuclear Research (INR) Pitesti: students preparing the engineering diploma, Ph.D. students preparing the thesis, mixed (simulations and experiments) training stages for students, joined participations at nuclear meetings and conferences involving students, professors and INR specialists.

The main results of developing the excellence network might attract all interested organizations in the Romanian nuclear field (even during the project) and thereby will permit its expansion to other areas related with the nuclear field.

Keywords: knowledge management, education networking, e-learning, SAT.

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1. Introduction

The setup of the excellence network for education and training in nuclear physics and engineering (REFIN) responds not only to some strategic objectives, but also to some specific situations:
- the requirements of the Romanian National Nuclear Program regarding the training of the skilled personnel;
 - the dispersion of the specialists with a high level of experience and knowledge;
- the expensive and complex research infrastructure fragmented enough and spread over various users. In some cases, research devices obtained in last years as a result of some grants could be used more efficiently in complex projects with many users, like the proposed project;
- last generation, high-performance computer codes as well as research instrumentation are also used by some licensed users.

The setup of the excellence network offers a wider access to these resources, within legal and/or contract constraints. Their use in the training process became a strong requirement of the regulatory authorities.

University Politehnica of Bucharest (UPB) has participated in FP-5 and FP-6 programs ENEN (European Nuclear Education Network) and NEPTUNO (Nuclear Engineering Platform for Training and Universities Organizations) and is a founder member of ENEN- Association.

The gained expertise entitled UPB to propose to the potential Romanian partners to create a network of excellence dedicated to nuclear education, similar to those already existing in different European countries, but taking into consideration the specific situation in Romania. The proposed network of excellence aims to gather together all the Romanian entities (universities, R/D centres, training facilities etc.) involved in nuclear education, and is based on the existing experience of Belgian Nuclear Education Network and ENEN projects.

The envisaged partners in the REFIN are University Politehnica Bucharest, University Bucharest, University in Pitesti, University "Babes-Bolyai" in Cluj, University "Ovidius" in Constanta, Institute for Nuclear Reserch in Pitesti, Institute for Physics and Nuclear Engineering in Bucharest (Magurele) with its Training Center for Nuclear Personnel, as well as ROMATOM as a representative of end users cluster. However the network is open to any interested and nuclear related entity.

2. Objectives

REFIN aims to develop an efficient, flexible and modern training system in the nuclear education area, which answers the requirements of nuclear industry (NPP, regulatory bodies, subcontractors, dismantling, radioprotection, waste

management) and redundant with the perspectives of the European Research Area (FP6, FP7, EURATOM).

The measurable objective of the project is to achieve a network of excellence for the education and training of human resources in nuclear field which can provide (related to the situation both in Romania and in the other UE countries):
- a better management of present knowledge and expertise;
- an increased and formalized co-operation between universities and between universities and R&D centers in order to better use the formative potential, the existing research devices, infrastructures and facilities;
- an enhanced learning process quality by introducing new courses, course modules and modern learning methods (e-learning);
- the organization of the learning process based on Systematic Approach to Training (SAT);
- an increased competitiveness in the European integration process.

All these objectives are in complete accordance with the strategic goals of the Romanian National Research Program of Excellence. Due to objectives and methods, this work is absolutely new in our country.

The work consists of gathering and processing the information, issuing proposals for a global strategy, of organizing a network of excellence (including development of pilot programs (courses, course modules), and of applying modern learning methods (e-learning, distance learning) and learning process organization (SAT), leading to strengthening of the training infrastructure for research/development in nuclear field.

The application of a systematic approach to training system (SAT) in university education has also an absolutely new character. The development of some pilot courses based on modern learning methods represents a recent concern, which did not find its place yet, although it represents a reality and a success in well-known technical universities from EU countries.

The first step was the investigation of the actual stage of the training in nuclear field in Romania. The objective of this work package was to analyze the present situation, the strong and week aspects of the training in the nuclear field in our country. The activities of this work package supplied information about:
- institutes which offer nuclear qualified training, existing specializations;
- existing and future personnel/staff structure;
- existing facilities at these institutes;
- the type and the contents of theoretical and practical courses;
- existing research infrastructure;
- qualification/competence of the trainers.
Based on the above information resulted conclusions and recommendations for the next work packages.

The second step was investigation of the actual stage of training in the field of nuclear physics and engineering in other European countries. The objective of this work package was to analyze the present situation and the development directions of the specific education connected to programs promoted in EU regarding the European Research Area (FP5, FP6, and FP7). The activities of this work package supplied information about:
- the nuclear engineering programs in the European countries (structure, duration, learning plans);
- some aspects related to the training for nuclear industry (end users: NPP, regulatory authorities);
- current trends.

Starting from the information about the present status in the mentioned nuclear area in Romania and in EU, RONEN developed a database on the project web-site www.refin.pub.ro. Although at present the site is in Romanian language, it will be also developed in English for a better access of the interested potential users. In this database is provided all the information regarding the existing nuclear training and education facilities in Romania and in Europe, about their curricula and offered courses. A list of links permits easy to share the information available all over the Europe on nuclear education.

Another major step was to create the infrastructure for implementation and development of modern teaching/learning programs and technologies. A delicate matter seemed to be the choice of the e-platform for distance learning. The costs of well known WebCT or Blackboard soft exceed the allocations for a pilot program and an open-source "Moodle" soft was chosen. For this e-platform were elaborated handbooks for teachers and for students, which were implemented on the web site. These tools will permit to each member of the network to implement in the next future his own courses for the e-learning offer. A diversified offer from different universities will stimulate competition and will be a guarantee for the self-improvement of the quality of the educational process.

The implementation of e-learning will also require an effort to pass from the weekly form of the courses to the modular, compact form, which will allow staff with different training to participate at different educational levels, where and when interested. This scheme will ensure enhancement of the competence, the possibility to up-grade the qualification, and a better mobility on the labor market.

From technical point of view, REFIN improves the quality of training in nuclear field, the competence of trainers and students, the efficient use of the facilities and the research infrastructures. It introduces advanced course packages, the use of modern training methods and harmonization with similar EU education system in view of the integration of Romania, with direct effects in increasing economical competitiveness, while fulfilling the sustainable development criteria.

The implementation of the proposed measures may help to develop technological and R&D capacity of all partners, and to increase the mobility of students and teachers at national and international level. Also, the project gives opportunities related to technological transfer from European partners, participating in ENEN, NEPTUNO and ENEN-II Programs, as well as from ENEN Association.

From the social point of view this project offers better opportunities for larger student categories in the field of education and training.

The excellence network for education and training in nuclear physics and engineering, REFIN, is presented in Table 1.

Table 1

REFIN network

Objectives of the network	To develop an efficient, flexible and modern training system in the nuclear education area, which answers the requirements of nuclear industry and redundant with the perspectives of the European Research Area
History of its creation	Started 2006
List of members	University "Politehnica" of Bucharest, University Bucharest, University of Pitesti, Institute for Nuclear Research in Pitesti, University "Babes-Bolyai" Cluj
Organisation of the network	The network is under construction and will be functional end 2008
First practical achievements	Participation to national research.Organisation of International Course on "Radioactive Waste Management" and of course on "Numerical and Experimental Methods in Nuclear Reactor Theory"
Organisation of the courses or programmes	E-learning platform implemented. All nuclear courses will be available for e-learning end 2008
Support from national nuclear sector	Support from National Society "Nuclearelectrica" (Romanian nuclear operator)
Links with other networks	ENEN, BNEN, CIRTEN (Polito)
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REFERENCES

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