

CONTRIBUTION OF THE TRAINING CENTRE- REGIONAL DESIGNATED
CENTRE ON EDUCATION AND TRAINING (RDC) ON RADIATION PROTECTION
OF NATIONAL CENTRE FOR NUCLEAR ENERGY, SCIENCE AND
TECHNOLOGY, CNESTEN ON BUILDING COMPETENCIES IN RADIOLOGICAL
SAFETY AT NATIONAL AND REGIONAL LEVEL

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Under its law of creation, Law No. 17-83, the National Centre for Nuclear Energy, Science and Technology (CNESTEN) "contributes to education and training of specialists needed for national nuclear power program, and other areas using nuclear techniques." During the thirty years of its existence, the CNESTEN Build competencies of his humans resources. Now he has a pool of about one hundred and half experts in several peaceful utilisations of Nuclear Techniques on socio economic areas (Health, Energy, Environment, Industry, Agriculture, Water, Management of the radioactive waste, Radiation protection, the Nuclear Safety and Nuclear Security, etc.). Thanks to the importance of the education and training in building and strengthening competencies to ensure a safe use of ionizing radiation in peaceful application and according to the national and regional needs, CNESTEN makes a strategy on developing Training Centre on Nuclear fields. Since 2012 CNESTEN is recognized by AFRA / IAEA as a "Regional Designated Centre" (RDC) in "Education and Training in Radiation protection and Safety of Waste Management".

In this paper, we propose to present our experience on the contribution of our centre in building competencies on Radiation protection and Safety of Waste Management in Morocco and in the Region such as the benefit of the networking for this success story with focus on our experience feedback on raining the IAEA Postgraduate Regional Education Course in Radiation protection and Safety of ionising radiation sources (PGEC).

1. Introduction

Recognizing the importance of education and training in building and strengthening radiation protection, and considering national and regional needs, CNESTEN made a strategic decision to establish a regional training centre for training in radiation protection.

In collaboration with IAEA and in association with several national partners, CNESTEN have organized the IAEA Postgraduate Regional Education Course in Radiation protection and Safety of ionising radiation sources (PGEC) on nine occasions, training some 197 participants from 20 nationalities of French-speaking African countries.

In 2012 CNESTEN was recognized by the AFRA / IAEA system as a "Regional Designated Centre" (RDC) in "Education and Training in Radiation protection and Safety of Waste Management".

Experience of running the IAEA PGEC has led to the development of other specific training courses and has built a fruitful network in the region.

2. National Centre for Nuclear Energy, Science and Technology (CNESTEN)

CNESTEN is a Public Institution founded in 1986 under the supervision of the Ministry of Energy, Mines, Water and Environment it has Legal and financial autonomy, Controlled by Administration Council.

Its missions are:

- Promoting nuclear applications (Research and services),
- Technical Support of the national Authorities (safety Radioprotection, radioactive waste...),
- Preparing the technological base of Nuclear Power Option.

Its human resources are 253 individuals mainly:

- About 1/3 Doctors and Engineers,
- About 1/3 Technicians,
- About 1/3 Administrative and Support.

3. CNESTEN Training Centre

Under its law of creation, Law No. 17-83, the CNESTEN "contribute to education and training of specialists needed for national nuclear power program, and other areas using nuclear techniques". During its thirty years of its existence, CNESTEN have significantly contributed to building competencies in radiation protection in Morocco and in the Africa region. . In CNESTEN, there is a pool of about one hundred and fifty experts in radiation protection, nuclear safety, nuclear security and various nuclear techniques spread across a wide range of applications that include the health sector, energy production, environment, industry, agriculture, water resources, and management of radioactive waste.

3.1. Three levels of intervention:

- National level: For setting a national infrastructure for Education, Training and Research in nuclear fields over various socio-economic areas,
- Regional level: For contributing to develop regional capabilities for safe use of radioactive sources,
- International level: For sharing experience and developing networking.

In the field of education and training CNESTEN developed a local, regional and international partnership. A thousand of professionals and students are trained per year totalling about 20 000 man-days of training per year, of which more than 30% are from foreign countries.

CNESTEN is recognized by the AFRA / IAEA system as "Regional Recognised Centre" (RDC) in four areas: "Education and Training in Radioprotection and Safety of Waste Management"; "Isotopic Hydrology" and "Nutrition" and Non Destructive Testing (NDT). CNESTEN host and cordon the "Nuclear Security Support Centre" (NSSC).

CNESTEN has set a long term vision for all its E&T activities by establishing an overall strategy to ensure sustainability, efficiency and effectiveness. As a result, a dedicated International Training Centre (ITC) for nuclear science and technology is under construction, and is expected to become operational during 2018. This ITC is open to national, regional and international collaboration.

3.2. Infrastructure supporting Education and Training activities:

- CNESTEN's Maamora Nuclear Studies Centre (CENM) including mainly the TRIGA MARK II Reactor and associated Laboratories in different nuclear applications and techniques

(Health, NDT, EPR, Radiation Protection, Nuclear Security, Isotope Hydrology, Environment, Material Science, Agriculture, ...);

- CNESTEN's Rabat Al-Irfane Training Facilities including a Visio-conference facility and rooms equipped with didactic material;
- CNESTEN's International Training Centre (ITC) for nuclear science and technology which is under construction, and is expected to become operational during 2018.
- Specific Facilities of CNESTEN partners. (Universities, Hospitals, Regulatory, ...)

4. Regional Training Centre (RTC) and Regional Designated Centre on Education and Training (RDC) on Radiation protection: IAEA and AFRA approach

In 2000, the 44th General Conference mandated the Secretariat (resolution GC (44)/RES/13) to intensify Post Graduate Educational Course (PGEC) activities and to develop syllabuses and training material for specific target groups and specific uses of radiation sources and radioactive materials.

The Secretariat was also urged to strengthen, within existing resources, the role of Regional Training Centres (**RTCs**) and to develop national training centre and to facilitate cooperation between such centres', on the one hand, and national and regional authorities and professional bodies on the other.

Over the years RTCs have been established with the Agency's support. The RTCs offer training in Arabic, English, French, Russian, Spanish and Portuguese; and they represent strong regional resources with respect to the implementation of the strategy.

The inter-governmental African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology (AFRA) is one of the regional agreements under the IAEA. AFRA entered into effect in 1990. The AFRA Member States have been carrying out cooperative projects in various fields of nuclear science and technology for socio-economic development. As an intergovernmental agreement AFRA translates the political commitment of Member States into regional cooperation and mutual assistance under the umbrella of Technical Cooperation among Developing Countries (TCDC). AFRA focuses on Capacity Building and networking among its member states. AFRA is fostering sustainable regional self-reliance and mutual assistance in Africa. This aim can be consolidated through the recognition of regional institutions in high priority fields (AFRA Regional Designated Centres (RDCs)).

The RDCs and RTCs on education and training in radiation protection are considered equivalents. Both procedures for the recognition of RDC/RTC include IAEA Education and Training Appraisal (EDUTA) mission and then conclusion of Memorandum of understanding for RDC and Long Term Agreement for RDC.

The RDCs/RTCs can act as a resource for building competence in radiation, transport and waste safety within the regions and play a useful and cost-effective role by complementing and supporting the activities of national institutions operating in similar fields.

One of The criteria set by IAEA/AFRA to the selection of RTCs/RDCs is "Regional centres should be established only in countries with adequate radiation protection infrastructure and national capability for training at the PGEC level".

In 2011 the AFRA committee recognized the following institutions as RDCs for Education and Training in Radiation protection:

- Nuclear Research Centre of Algeria (CRNA),
- School of Nuclear and allied Sciences of the University of Ghana (SNAS),
- National Centre for Nuclear Energy, Science and Technology (CNESTEN) Morocco.

5. Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources – PGEC

The aim of the Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources is to meet the needs of professionals at graduate level, or the equivalent, for initial training to acquire a sound basis in radiation protection and the safety of radiation sources. The course also aims to provide the necessary basic tools for those who will be recognized as qualified expert in radiation protection in the later years and be involved in education and training in radiation protection and Safety of Radiation Sources in their home countries. It is designed to provide both theoretical and practical training in the multidisciplinary scientific and/or technical bases of international recommendations and standards on radiation protection and their implementation. The participants should have had a formal education to a level equivalent to a university degree in the physical, chemical or life sciences or engineering and should have been selected to work in the field of radiation protection and the safe use of radiation sources in their countries.

- The PGEC is based on the IAEA syllabus.
- The original version of the standards syllabus of PGEC was published in 1995.
- The first revised version has been published in 2002. TRAINING COURSES SERIES No. 18. (Official publication).

The Standard Syllabus of the Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources is divided into eleven parts. The total minimum suggested duration is 18 weeks

The second revised version in 2008 has been approved by the steering committee on education and training in radioprotection and waste safety (SC).

The third revision in 2010, approved by the SC, is under processes of Publication

The revision takes into account the requirements of the IAEA Revision of Safety Series and related Safety Guides, and recommendations of the Steering Committee as well as experience gained from the conduct of the Postgraduate Educational Course in Radiation Protection.

The PGEC is regularly conducted in several regional training centres in recent years in Algeria, Argentina, Brazil, Belarus, Ghana, Greece, Malaysia, Morocco and Syria.

6. Moroccan experience on conduction of the PGEC

6.1. Background

Recognizing the importance of education and training in building and strengthening radiation protection, and considering national and regional needs, CNESTEN made a strategic decision to establish a regional training centre for training in radiation protection.

In the first stage, a tripartite partnership between CNESTEN-IAEA-INSTN France has been done. In 1998 CNESTEN, on collaboration with IAEA, and INSTN France organized, in association with national partners, organized a pilot session at Morocco. The duration of this session was 09 weeks.

In 2001 CNESTEN was considered by the IAEA as a Regional Centre for African French speaking countries in Radiation Protection and the Safety of Radiation Sources.

The first session of PGEC-Morocco was conducted in 2002 with 20 weeks duration.

Since CNESTEN conducts regularly PGEC-Morocco with 21 weeks duration. In collaboration with IAEA, CNESTEN organized, in association with national partners, seven editions of the

Postgraduate Regional Education Course (PGEC) in Radioprotection and Safety of ionising radiation sources.157 participants from 19 nationalities of French-speaking African has been trained

In 2007 CNESTEN received IAEA EduTa mission.

In 2010 he received AFRA/IAEA EduTa mission.

In 2012 CNESTEN was recognized by the AFRA / IAEA system as a “Regional Designated Centre” (RDC) in “Education and Training in Radiation protection and Safety of Waste Management”.

6.2. Context

The principals’ points of Moroccan PGEC context are:

- Collaboration between IAEA and Government of Morocco through the CNESTEN,
- Host agreement between IAEA and Government of Morocco under projects RAF/9/028; RAF/9/035, RAF/9/048 and RAF/9/056,
- Agreement between CNESTEN and School Mohammadia of Engineers (EMI). EMI give a certificate to the participants who succeed on final exam,
- Partnership between CNESTEN and national Institutions,
- National Partners: School Mohammadia of Engineers, National Centre of Radiation protection (CNRP), the new National Agency for Nuclear Safety and Security(AMSNOUR), Scientific University, Medical and Pharmacy University; National Institute of Oncology (INO), Military hospital Mohammed V, National Institute of Agronomic Research (INRA).

6.3. Organization

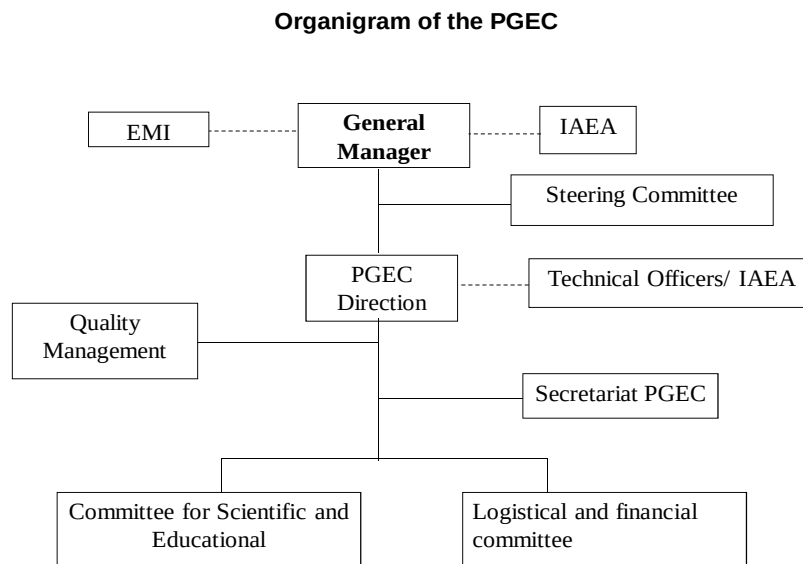


Fig.1: Organization of the PGEC.

According to this organization the role and responsibilities of the actors in PGEC team are clearly define on document of organisation. This team is the work force for success and continual improvement of the PGEC.

6.4. Program

- The program of the Course is based on the IAEA Standard Syllabus and articulated around 11 modules;
- The duration of the course is 21 weeks;
- Content :
 - 242 Lecture sessions;
 - 86 Exercises sessions;
 - 62 of Practical Exercises sessions;
 - 27 Tutoed sessions;
 - 41 Sessions of Examination, 1 Final Exam;
 - 11 Technical Visits,
 - 30 Sessions Project assignments.
- Lectures' Institutions:
 - CNESTEN;
 - Moroccan Institutions;
 - IAEA.
- Program:

Module	Title	Duration (week)
I	Review of fundamentals	2
II	Quantities Measurements	2
III	Biological effects of Ionizing Radiation	1
IV	Principles of radiation protection and Regulatory control	2
V	Assessment of external and internal exposure	2
VI	Protection against occupational exposure	4
VII	Medical exposure	1,5
VIII	Public exposure	2
IX	Accidental exposure	2
X	Training the trainers	1
XI	Project assignment	
	Global evaluation	1,5
Total		21

Table 1: Program of Moroccan PGEC

- **Technical visits :**
 - Technical visits TRIGA MARK II reactor;

- Technical visits to radioisotopes production lab;
- Technical visit to Environment monitoring Unit;
- Technical visit to Dosimeter lab
- Technical visit to an irradiator facility;
- Technical visits to private and public hospitals;
- Technical visit to an industrial radiography facility;
- Technical visit to an SSDL facility;
- Technical visit to National Centre of Radiation protection (CNRP)

- **Social Program**

- Visits
 - to Rabat;
 - to Casablanca;
 - to Tangier;
 - to Fes ;
 - to Marrakech.
- Others special social events: (Aïd Al Adha, Chrismes, Achoura, etc.)

6.5. Mechanisms of Assessment and Evaluation

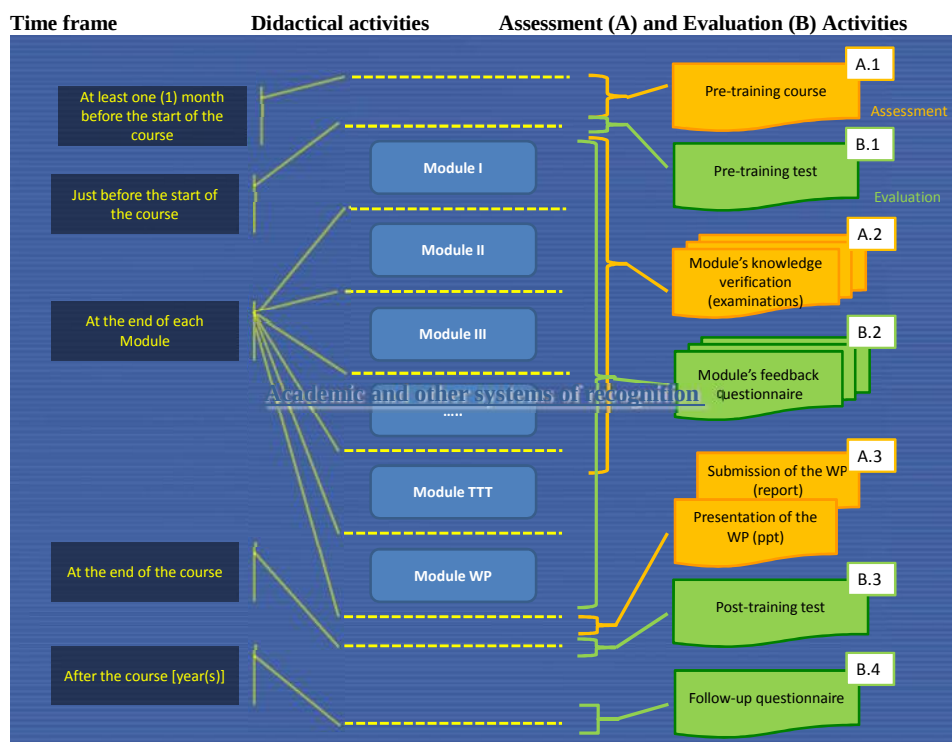


Fig.2: PGEC Assessment and Evaluation mechanism

The Assessment and evaluation of the PGEC consists on Assessment of knowledge acquisition and Evaluation of the course.

- **Assessment of knowledge acquisition :**
 - Pre-training course
 - Knowledge Assessment for each module,
 - Finale exam,
 - Project assignment.

➤ **Evaluation of the course:**

- Pre-training and post-training test
- Intermediate evaluations
 - Questionnaire/module (feedback students),
 - Oral Intermediates evaluations (students, pedagogical and logistic committees),
 - Feedback lecture.
- Global evaluation
 - IAEA questionnaire (students),
 - Oral evaluation (students, represented of IAEA, steering committee, pedagogical and logistic committees),
 - Modules coordinators feedback (Module report).
- Follow up questionnaires

➤ **Key Indicators:**

- **Evolution of % Local Lecturers / Total: 70% to 90%**

Edition	non local lecturers	local lecturers	% of local lecturers
2002-2003	19	45	70 %
2003-2004	11	49	80 %
2004-2005	8	49	85 %
2005-2006	8	49	85 %
2006-2007	5	49	90 %
2008-2017	3-5	50	>90%

Table 2: Evolution of % Local Lecturers / Total: 70% to 90%

- **Evaluation of the course by the participants:**

1	2	3	4	5
To be stongly improved	To be improuved	Well	Very well	Excellent

Table 3: Scale of IAEA Questionnaire (Evaluation of the course by the participants)

- Knowledge Improvement:

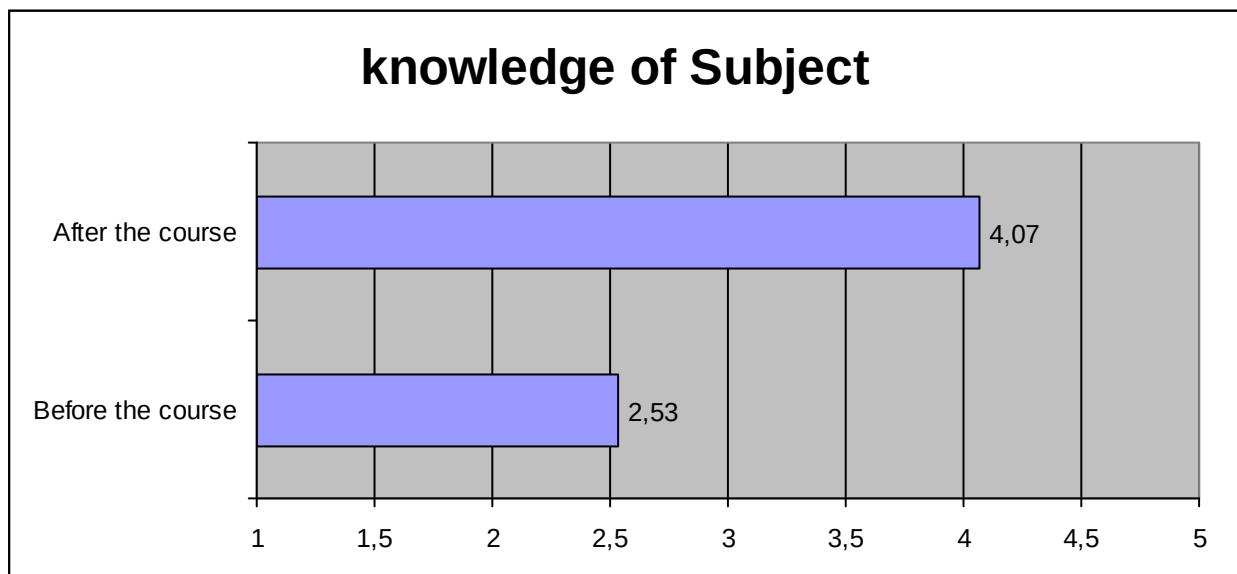


Fig 3: Knowledge Improvement

- Participants' Course evaluation

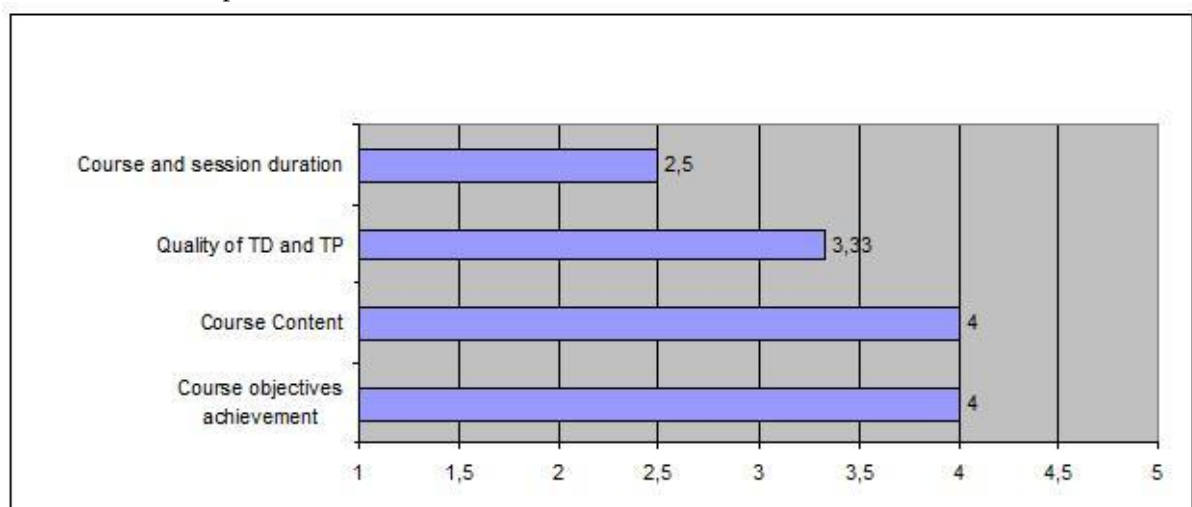


Fig4: Participants' Course evaluation

- Number of trained:
 - Trained, total number : 197
 - Country : 20 nationalities
 - Profiles :
 - Exploitation and regulation
 - Regulatory body;
 - Medical sector;
 - Mining Sector;
 - Students;
 - Industries, Environment, Emergency response, Research.

6.6. Academic and other systems of recognition

- EMI (Mohammedia Engineering School) gives certificate to the participants who success the exams.
- EMI fellow all the process of running PGEC. It has to be compatible with The EMI system (prerequisites, conditions of Knowledge evaluation of the participants, experience of lecturers, etc.).

6.7. Quality management system

According to the commitment of the Top Management for continue improvement of the PGEC and Recommendations of the EduTa Mission, CNESTEN mad decision to go through PGEC Quality management system. The quality approach could be summarized as billow:

➤ Quality Approach :

- Design of Quality Committee;
- Call for 02 experts for evaluation and implementation of quality system;
- Quality Action Plan based on the process approach according to the following standards :
 - ISO 9001:2008 QMS;
 - ISO 10015:1999 Guidelines for Training;
 - IWA 2: 2007 Guidelines for the Application of ISO 9001:2000 in education;
- Definition and mapping of Process;
- Drafting documents and definition of the organization and responsibilities;
- Drafting and approval the first version of the Quality Manual;
- Overall assessment of the previous session PGEC;
- Review of Quality Manual;
- Drafting processes, procedures and record;
- improvement and locking management training system;
- Certification ISO 9001;
- Use this experience to bring the system to the training centre;

➤ Mapping process

The following figure 2 illustrates the mapping process of the PGEC training course.

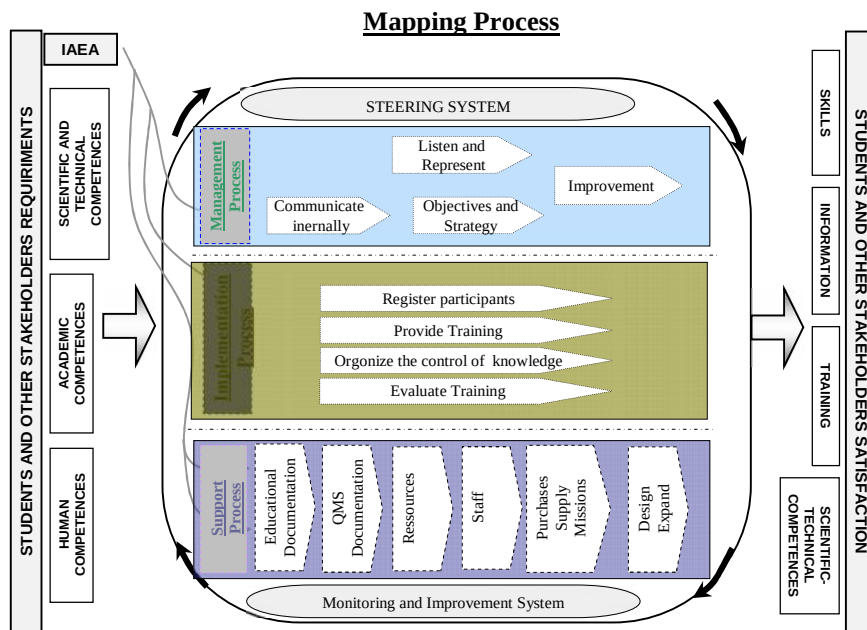


Fig.5: Mapping process of the PGEC

7. Conclusions

- Sustainability of the Training;
- Enriching experience feedback;
- Our objective is to continually improve radiation protection in a sustainable manner, both nationally and regionally, through education & training;
- Experience of running the IAEA PGEC has led to the development of other specific training courses and has built a fruitful network in the region.

8. References:

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18. ETRAP conference 2013-2017 doc