

ISCTN: CUBAN STRATEGY FOR REPRODUCING, PRESERVING AND DEVELOPING THE NUCLEAR KNOWLEDGE

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Abstract. One of the problems in the changing world is the preservation of the knowledge for the next human generation and the nuclear knowledge is not an exception. Cuba has worked for reproducing, preserving, developing and capturing the nuclear knowledge, mainly through a higher education center, the Higher Institute of Nuclear Sciences and Technologies. This institute is a component of a national network in the preparation of Manpower not only for nuclear activities and for environmental and managerial too.

1. Introduction

Actually, one of the problems in the changing world is the preservation of the knowledge for the next human generation, because the information grows and grows up very rapidly. In the case of nuclear activities, the accumulated scientific and technological experiences, not only thinking on nuclear power plant, are to be preserved taking into account the challenges of the present century, in which, one is witness of new applications in different areas of the human activity.

The aim of this contribution is to present the Cuban approach through a higher education center. This is the case of Higher Institute of Nuclear Sciences and Technologies, one of the Cuban universities. The second goal is to show the role-play by the national network in the preparation of the Manpower and in the continuity of the studies. Furthermore, it demonstrates how is possible to increase the qualification of personnel when different kinds of centers participate and collaborate with the releasing of the nuclear culture to other fields.

2. The Cuban Nuclear Manpower System

2.1. Early years

The necessity of nuclear professionals to assume the Cuban Nuclear Program was the principal reason for the government to begin the preparation of personnel on nuclear topics. Since the decade of 1960, a small group of physic and engineering students was prepared in Cuba and in the Soviet Union. Later, in 1981, the Faculty of Nuclear Sciences and Technologies (FCTN), in Havana University, was created with the mission of reproducing the Cuban nuclear system. At the beginning the Faculty was devoted to prepare the manpower for the future nuclear power plant; later, the Institute moved to other tasks related, mainly, with the preparation of personnel for nuclear applications.

The nuclear application in Cuban economy was growing. In 1987, the FCTN was separated from Havana University and it became Higher Institute of Nuclear Sciences and Technologies (ISCTN). Its mission is the preparation of nuclear professionals with high qualification, able to respond to Cuban Nuclear Program.

When one talk about the “reproduction of the Cuban Nuclear System”, one has to keep in mind that such a reproduction has to meet international standards and that the preparation of the manpower in this field could not be a task of one Institution alone. It is necessary to incorporate the best national experience and practices as well as the knowledge accumulated worldwide. Therefore a national system needs to be supported by a strong international cooperation, as for example, with the International Atomic Energy Agency (IAEA).

On the other hand, from the national point of view, it is important to integrate, at less conceptually, the institutions dealing with the development of nuclear practices. This is also a way to contribute to capturing the nuclear knowledge through the establishment of networks.

Our experience was the creation of the ISCTN as a reduced core (with a reduced number of staff members) in which the rest of the national nuclear institutions were acting as “teaching units” at all levels. The main experimental and applied activities were and are performed in these teaching units so that the students could capture in a direct way the best nuclear practices and culture.

Our model is a model of “vertical education” (beginning at graduate level) of Manpower. The vertical education has, at graduate level, a strong component of basic sciences (mathematic, physics, chemistry, and high performance computing), an important component of special training related to the nuclear and managerial fields (project management, quality assessment, etc.) and a complementary schema of postgraduate activities. This schema allows to close the cycle of preparation and to develop the fundamental skills for the nuclear applications and other scientific and applied activities within the national job market.

2.2. Changes in the Cuban Nuclear Manpower System

In 1992, the situation in the world changes and it was necessary to stop the construction of nuclear power plant, in Cienfuegos. The Cuban government decided to continue the preparation of nuclear professionals. At that moment, it was analyzed the key areas of nuclear sciences and technologies: basic sciences, safety culture, management, quality assurance and environmental protection. And it was decided to extend these key areas to other industries and sciences. For that, different Chairs were created (see Table I).

Table I. Chairs of the ISCTN

Chairs	Year of creation
	19
Environment	94
	19
Industrial Safety	95
	19
Theory and Tools for Science and Innovation Management	96
	19
Industrial Property	96
	19
Energy Studies	96
	19
Petroleum Technology	98
	19
History of Cuban Agriculture	98
	20
Human Resource Management	01
	20
Tourism	02
	20
Juridical Studies	03
	20
Science Divulagation	03
	20
Metrology	03
	20
Quality and Normalization	03

They began to promote the qualification of working personnel in different industries and centers, including health institutions, through postgraduate activities and workshops. Some information about the postgraduate activities developed by Chairs from their creation is summarized in Tables II and III.

Table II. Postgraduate activities promoted and taught by ISCTN' Chairs

Topic of Postgraduate Course	Quantity of Activities	Graduate d
Safety Culture	12	130
Management	49	821
Quality Assurance and Management	8	96
Radiological Protection	9	82
Environment	45	444
Nuclear Physics	9	47
Radiochemistry	12	90
Application of Nuclear Sciences and Technologies	31	445
Knowledge Management	4	60
TOTAL	179	2215

Table III. Diplomas promoted and taught by ISCTN' Chairs

Diplomas on	Quantity of Activities	Graduate d
Environmental Protection	4	38
Institutional Management	3	67
Technological Management	2	37
Educational Management	4	48
Industrial Safety	1	11
Environmental Education	2	35
Environmental Management	2	32
Managerial Techniques	4	77
Management	2	22
TOTAL	24	367

2.3. Last years

In 1994, the Ministry of Science, Technology and Environment (CITMA) was created by government decision and ISCTN became in the University of CITMA. This institute forms

part of the Cuban Nuclear Agency (see Fig. 1), a network of centers (one production center, two research centers, one center of information and one center of management of radiological wastes).

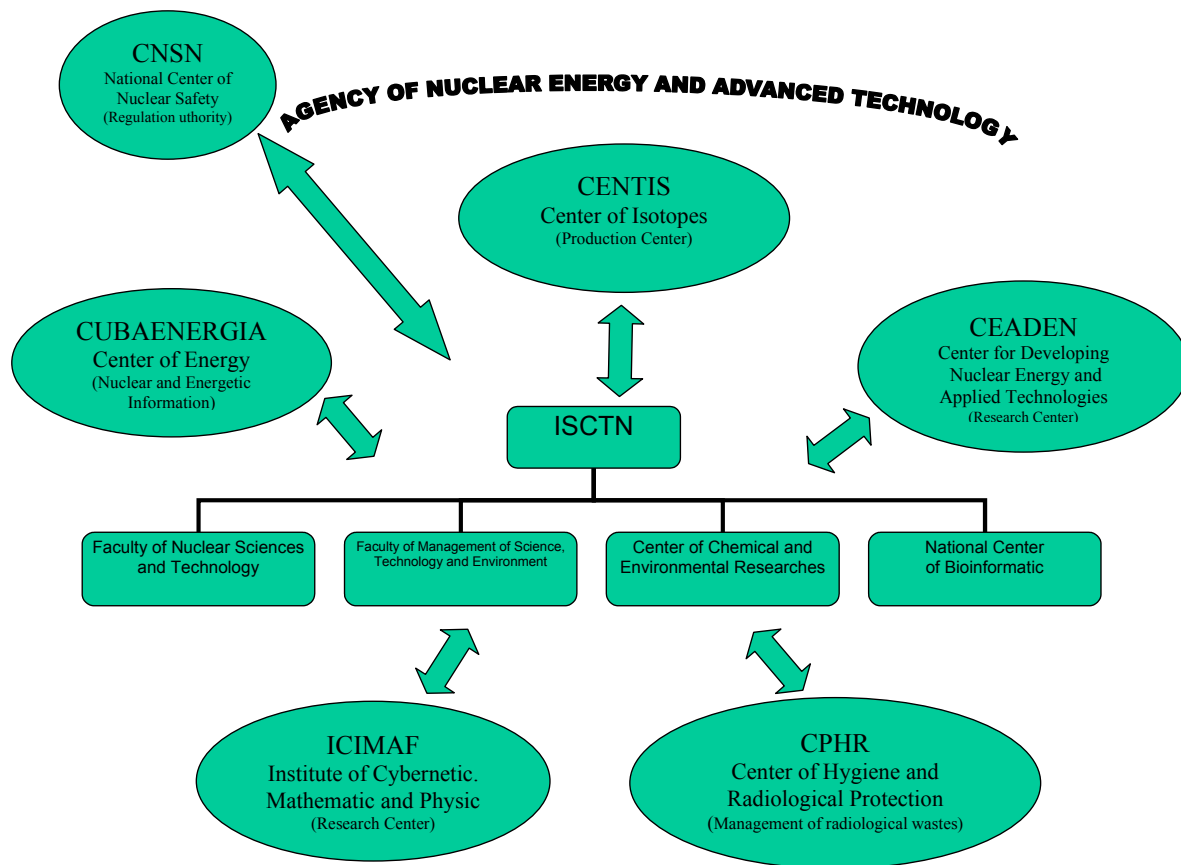


FIG 1. ISCTN as a component of a network of centers

Professionals of all this centers contribute to the reproduction, preservation and development of the nuclear knowledge participating as associated professors (see Fig. 2) or guiding the students in their research works, graduate activities, as well as in Mastership and Ph.D. programs.

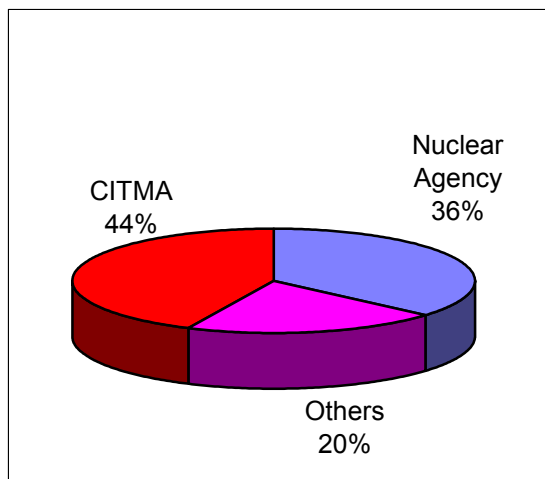


FIG 2. ISCTN' Associated Professors

Other form of reproduction, preservation and development of nuclear knowledge is the collaboration of all these institutions, working together in different kinds of projects in relation to diverse topics. In order to fulfill the mission, the Institute of Mathematical and Physical Research (ICIMAF) was incorporated to the Cuban Nuclear Agency.

The access of students to the ISCTN is through a rigorous process based on special requirements. With this base, the students are forming as Nuclear Engineer (Energetic (EN) and *Nuclear Engineering (IFN, IN)*), *Nuclear Physics (FN)* and *Radiochemistry (RQ)*. Recently, *Meteorology* was incorporated to the set of bachelor program [1].

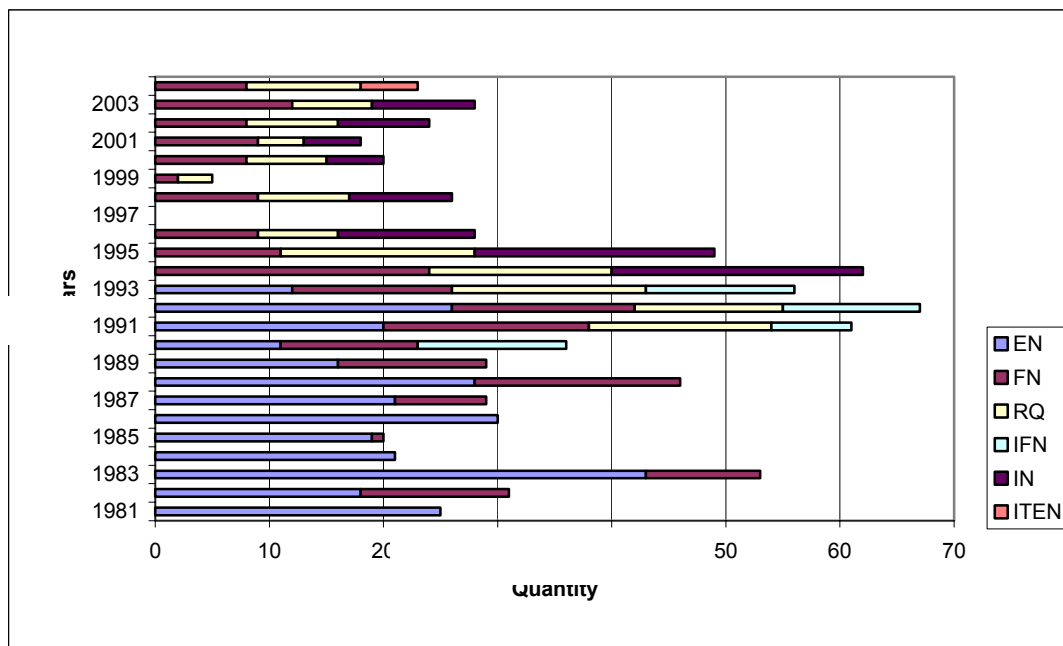


FIG 3. Graduated as Bachelors at the ISCTN

different kinds of academic program are in operation at the ISCTN: bachelors (5 years plus Diploma), MSc (2 years plus Diploma) and PhD (3-4 years). All the mentioned programs are implemented through the network allowing the realization of the corresponding graduate diploma in accordance with the needs of the main institutions involved with.

In July 2003, the ISCTN changes the name by Higher Institute of Technologies and Applied Sciences (InSTEC) as a result of the development of the center [2].

3. Conclusion

- National networking including Higher Education, Research and Production Centers is a powerful way for capturing, preservation, reproduction and development of nuclear knowledge.
- Vertical formation (at graduate level) of Manpower is still valid if one look for a broad profile of output.
- The Cuban strategy is a way to increase student enrolment in nuclear activities. Because if the student has a wide profile, he is able to insert himself in the job market, more rapidly and easy to adapt and reorients in the changing world conditions. In this way it is also possible to increase the motivation of the students for nuclear activities.
- The nuclear culture is good basis for preparation on Manpower in a comprehensive way.

REFERENCES

- [1] GUZMÁN, M. F., et al., “ISCTN: Nueva etapa de formación de profesionales nucleares de perfil ancho”, NUCLEUS 30 (2001) 53.
- [2] BASES para la ampliación del Instituto Superior de Ciencias y Tecnologías Nucleares como Universidad del CITMA, Inf. Int. Dirección del Ministerio de Ciencia, Tecnología y Medio Ambiente, La Habana (1999), 40.