

# **Analysis of the Motivations of the Retiring Experts for KT in INR**

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**Abstract.** The organizational strength does not come from knowledge of the past per se; rather, it comes from the ability to regenerate knowledge of the organization, its processes and its markets. Our analysis is intended to answer: ‘what is INR core competency?’ ‘what are the characteristics of the actual INR market, and what are the predictions?’ ‘what did we learn from our history?’ ‘what are the optimal methods to solve INR problems in KM?’ For the next period, since many experienced researchers should retire in 5-10 years, the knowledge preservation (KP) in INR is a stringent aspect. The problem is connected with the divergence between the organizational interests (effective and efficient KT) and the interests of experienced people (do not transfer the important part of their knowledge). In order to solve this sore point we performed a questionnaire-based investigation with the intention to obtain the general matrix of interests. The final objective of our work is to harmonize the organizational and retiring personnel interests. A short and long-term strategy is presented in the full paper.

## **INR Core Competency**

Since its foundation, in 1971, the Institute for Nuclear Research Pitesti (INR), had the mission to foster the peaceful utilization of nuclear power. During this period, the Institute developed technologies, methods, computer codes, its own experimental infrastructure, directed towards an end-product or service with applications in a nuclear power plant (NPP). The Institute continues to act as a technical support institute for the safe and economical operation of the NPP, in accordance with National Nuclear Programme and international agreements on the safety of nuclear installations. During the last 15 years, the research activity of the INR was mainly oriented towards applied and engineering research, within programmes with objectives connected to the CANDU NPP. To achieve these objectives, the Institute activities are oriented in the following main research areas:

- Reactor Physics and Nuclear Safety;
- Irradiation and Post-Irradiation Tests;
- Nuclear Fuel Cycles;
- Material Analysis and Evaluation;
- Out-of-Pile Testing;
- Radioactive Waste Management;
- Electronics, Instrumentation and Control;
- Radiation Protection, Environmental Protection and Civil Defense;
- Equipment Design, Development and Testing;
- Reliability and Testing;
- Quality Management.

The structure of the Institute research programmes is fully compliant with the research programmes engaged by the CANDU owners community. This also improves the ground of international scientific cooperation and exchanges throughout Europe and the whole nuclear world, which acknowledges INR as a valuable partner.

The most known product of INR is the Romanian nuclear fuel technology. Most of the know-how was obtained in ‘80s. The pilot unit was designed, built and operated in INR. In 1992 the know-how,

buildings, installations and people are transferred in the new company Nuclear Fuel Factory. Is a good example of knowledge transfer (KT) in our history.

In Fig.1 the knowledge creating hierachy in INR is presented. Physical processes are the subject of our research. INR cover activities of observation, organizing, understanding, syntesis and application colecting and organizing data, producing information, creating knowledge and obtaing 'the wisdom' in some subdomain.

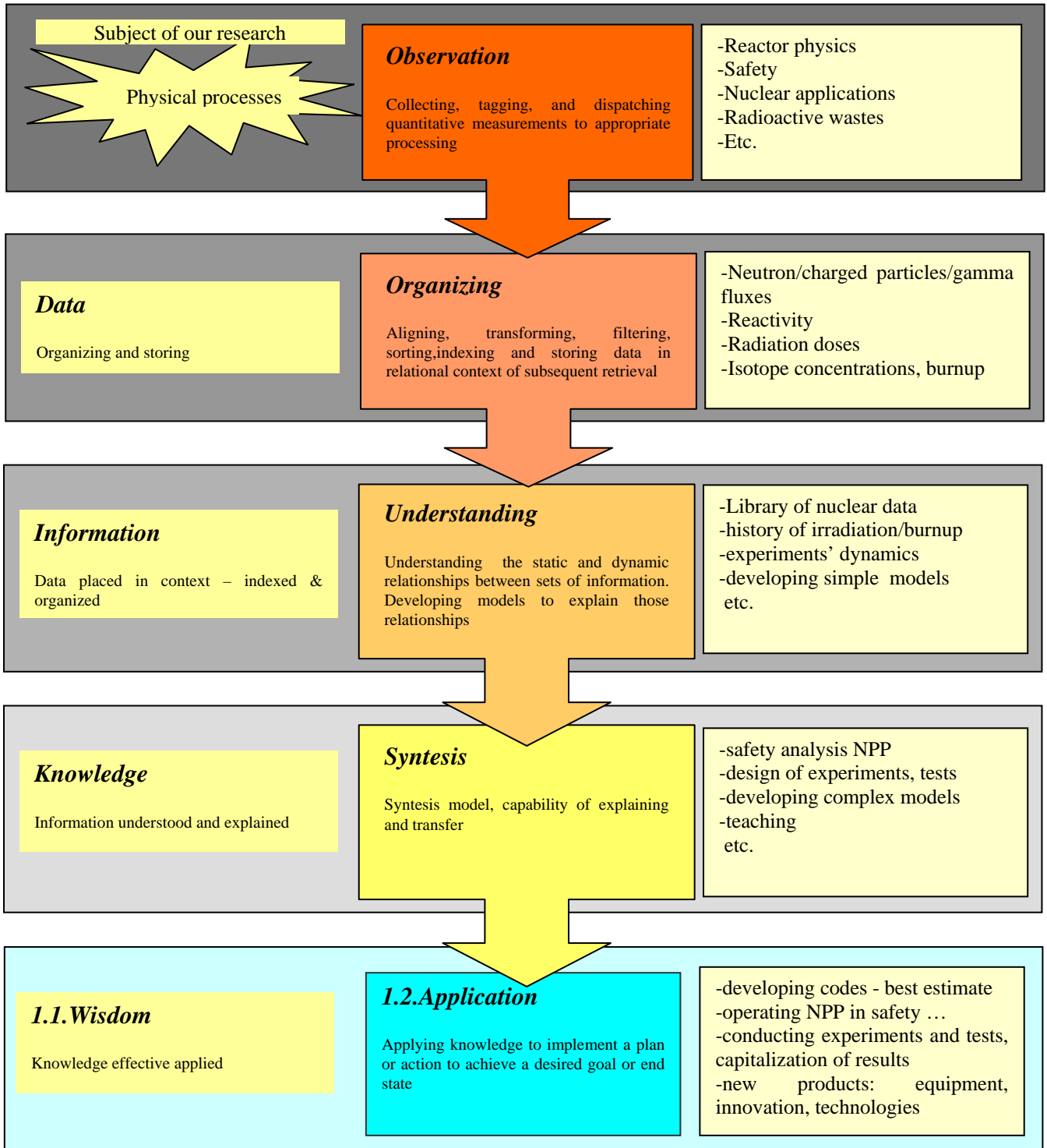


Fig. 1 Knowledge creating hierachy in INR

## **Market characteristics**

INR is one of the actors of the nuclear business in Romania offering studies, analysis, services, consultancy and end-products like electronic devices, technologies, sources, etc. The INR market is characterized by:

- continuous development of nuclear energy (Unit 2 in construction, for Unit 3 and 4 a political decision to build them exists); in Romania nuclear power is a relative young activity, but nuclear field is active since '50s;
- rapid movement of the contracts from large and heterogeneous to small and very specialized companies;
- marginal position of the nuclear domain in national research funds competitions;
- advantages of projects in consortium with universities, international companies and research institutes;

## **Predictions on medium and long term**

On medium term we expect INR will maintain the actual position in supporting technical and research activities for NPP Unit 1 and 2 operation and for Unit 3 and 4 developing.

An important part of our activity will be dedicated to:

- the design, producing and testing of new fuel bundle type (from natural uranium to slow enriched uranium);
- radioactive waste research activities including treatment, storing, final disposal etc.
- activities related to safety for NPP and other nuclear facilities;

Taking into account the Romanian market restrictions INR will be implied in:

- international project related to innovative reactor concept, material testing;
- educational activities including e-learning, support for university – labs, computer codes etc.;
- nuclear applications: material analysis, irradiations, non-destructive investigations, developing of new methods etc.

## **Learning from our history**

In '90s INR has confronted with an important loss of researchers and high qualified personnel by:

- emigration (in the first 5-10 years after '89 Romanian Revolution);
- retirement and attrition (INR, SITON, FCN, ANDRAD);
- layoffs (reducing of personnel by Romanian economy restructuring);
- cancellation by employee;
- reorganization.

Moreover, the average age of the personell has increased continuously in the las 10 years from 35 to 46. Important difficulties have appeared especially for tacit knowledge transfer:

- some groups disappeared;
- loss of capacity to act effectively in some domains, thus some activities are drastically reduced or abandoned.

Before 2000 INR had not a knowledge management (KM) strategy and the managers were not interested in KM aspects. Despite of this absence the position in the market and the main part of the organizational knowledge remain unaffected. Therefore, the question is 'what mechanisms have effectively actioned in order to preserve the knowledge in such a difficult period?' We identified the following factors:

1. the absence of an extreme specialization for most of the personell (each person has a large background application, covers many activities - that is very appropriate to use the rotation principle);
2. the redundancy in research activities;
3. an important part of the experienced personell remained in INR motivated by job/work dedication and not influenced drastically by industries/universities/business salaries;
4. KM activities were partial covered by Quality Management Activity (embedding in procedures)– INR was ISO9001 certified in 2001, but the process of quality assurance was started early in '80s.

Another important aspect appears from the history before December 1989. More than 10% of personnel was annually replaced by young people (mainly graduates). INR have worked as a research lab/advanced school where young graduates have continued their learning, generally in the form of a community of practice. Since about 75% of this personnel left the INR after 3-5 years of "apprentice" the community of practice was effectively accelerated by:

- experienced researchers needed young researchers rapidly obtained in guided research programmes;
- young people are very interested to gain an important experience in order to obtain a better job in INR or in another institute.

### **Motivations for Knowledge Transfer**

Predictable loss of experienced personnel in INR for the next 10 years, mainly by retirement, requires countermeasures from the point of view of KP. Obviously the harvesting of the tacit knowledge of the experts and converting it into a form that is available and useful should be the crucial point of KP activity. It includes:

- finding valuable know-how;
- getting inside the mind of experts to uncover the processes involved;
- optimizing and deploying the know-how to individuals and teams as software applications;
- evaluating and improving applications.

INR should encourage software applications development and dissemination of them in all the departments of the institute. At the same time in the building up of a new and younger staff process we need to fight with the idea 'balast is discharged', very present in the mind of the short term retiring experts. In this context our question is "what are the motivations for an expert to transfer his expertise before retirement?"

The following alternative to continue the previous work for retired experts are possible in Romania:

- (a) founding consulting companies, often in strong relation with mother companies (applicable for early retirement of top experts and managers);
- (b) working with part-time contract for other companies, including universities and research institutes;
- (c) working with part-time contract in INR activities.
- (d) retiring postponement - INR Scientific Committee annual approval is needed (possible for experts until 70 years old);

Each alternative introduces important financial advantages after retiring and is a real obstacle for KT before retiring. Therefore alternative methods are needed. In [2] two useful methods are presented:

- (1) continuous training of the "successors". In many European companies the current positions holders try to maintain their knowledge monopoly (power position) till the last day. In Japan the successor is introduced step by step into his future tasks in order to guarantee KT in critical areas.
- (2) 'Sempai-Kohai' method. It consists of a KT in a pair sempai-kohai (older-younger) and it is very effective for tacit knowledge transfer. "The relationship is strengthened by shared leisure activities in a systematic way so that the trust can be built for the free-flow of information of all kind [2]".

The main tools used in EU is "the structured exit-interview", conducted by trained experts and coordinated by the successor [2]. These interviews are intended to capture critical knowledge of the person (special documents, contacts, learning references, etc.). Despite a very detailed preparing the exit-interviews cannot transfer a large part of the tacit knowledge, especially if the interest of transfer of the retiring person is at a low level.

In order to understand the actual INR KT state, a questionnaire-based investigation was performed in January 2007 involving an important part of INR experienced people (about 100 persons). The structure of the investigated group includes physicists, engineers, researchers, technical staff from all INR departments and before mentioned activities. From the point of view of the experience, the dominant subgroup (35%) is represented by people with 26-30 years of experience (Figure 2).

The perception about the importance of the own accumulated knowledge for the INR organization and for the own team is shown in figure 3.

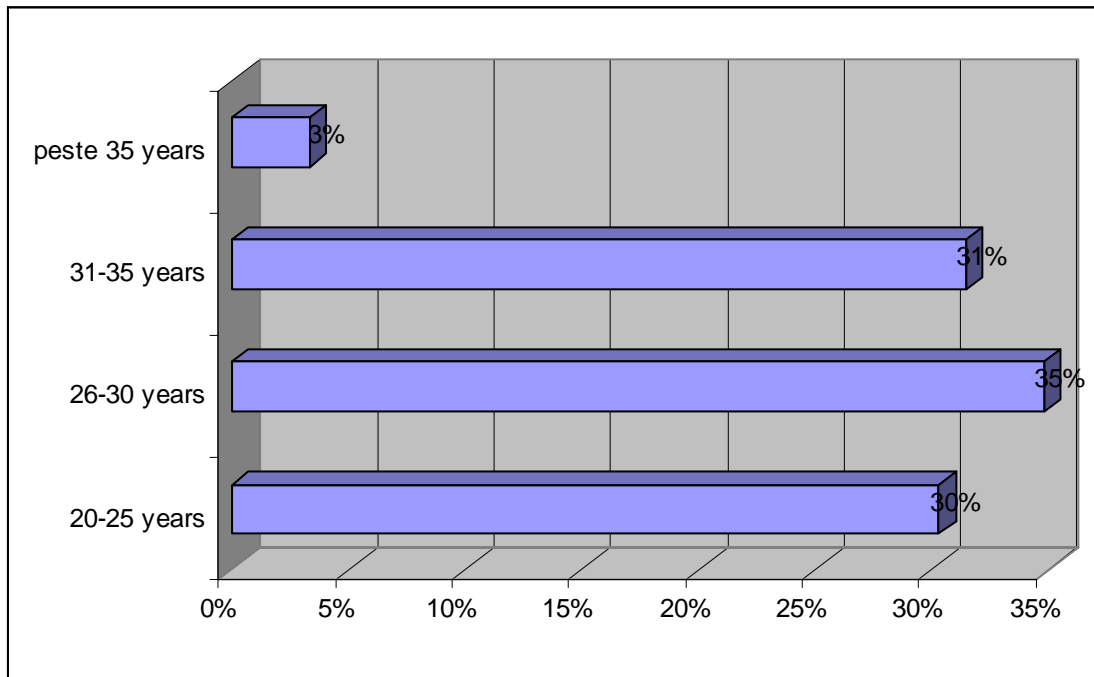


Fig.2 Structure of the group – years of experience

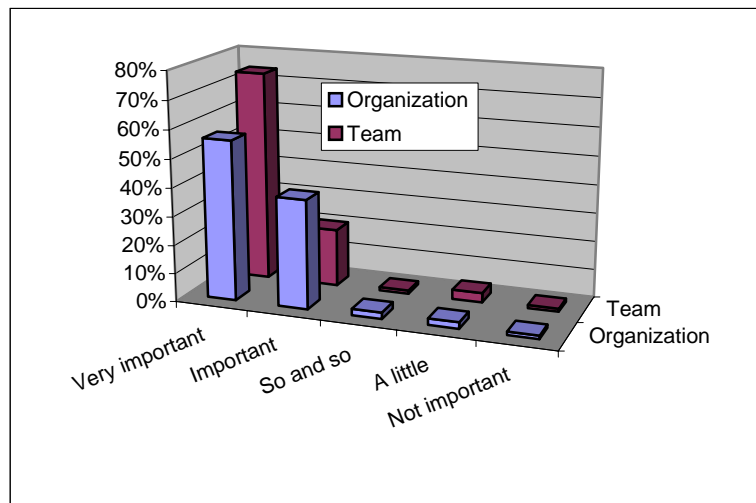


Fig.3 Perception for the importance of the own knowledge

The importance of the transfer knowledge process involving the own experience and expertise is perceived as very important by 73% of respondents and as important by 24%.

For the perception of the needed interval time for an optimal KT process of the main part of the expertise the following results were obtained:

- between 1 and 3 years -30%;
- 4 to 6 years- 48%,
- 7 to 9 years 17%;
- more than 9 years- 3%.

Our analysis includes the perception of the following KT methods' effectiveness in INR: (M1) reports, (M2) procedures, (M3) user's manuals, (M4) computer codes, (M5) articles/papers, (M6) books, (M7) community of practice, (M8) mentoring, (M9) continuous training of the "succesors", (M10) 'expert-

newcomer tandem' method. The perceived effectivity of KT process by the different methods both is presented in the Table 1.

Table 1 Perception about the effectivity of the KT methods

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
Very much	36%	36%	17%	11%	10%	6%	20%	12%	4%	2%
Much	28%	35%	31%	36%	19%	18%	33%	15%	21%	24%
So and so	11%	18%	20%	20%	29%	20%	19%	31%	18%	21%
A little	13%	4%	18%	13%	25%	24%	21%	19%	18%	34%
Not at all	7%	7%	11%	13%	12%	29%	7%	22%	37%	18%
Non Answer	4%	0%	2%	6%	4%	3%	0%	0%	1%	1%

Other results are related to the perception about the action of the following barriers against knowledge sharing [3]:

- (B1) lack of time (or the pressure on productivity, on deadlines);
- (B2) lack of trust;
- (B3) people grouping in functional departments/ buildings;
- (B4) poor means of knowledge capture;
- (B5) internal competition;
- (B6) top-down decision making;
- (B7) lack of awareness of how useful particular knowledge is to others;
- (B8) low interest of the knowledge receivers;
- (B9) the syndrome “knowledge is power”;
- (B10) lack of discussion/social events/working in teams (the individualism).

Detailed results of the perceived importance of each barrier on a 1 to 5 scale, for INR personnel, were obtained. In fig. 4 the perceived effectivity and non-effectivity of the barriers are presented (cumulated positive, and respectively negative appreciations).

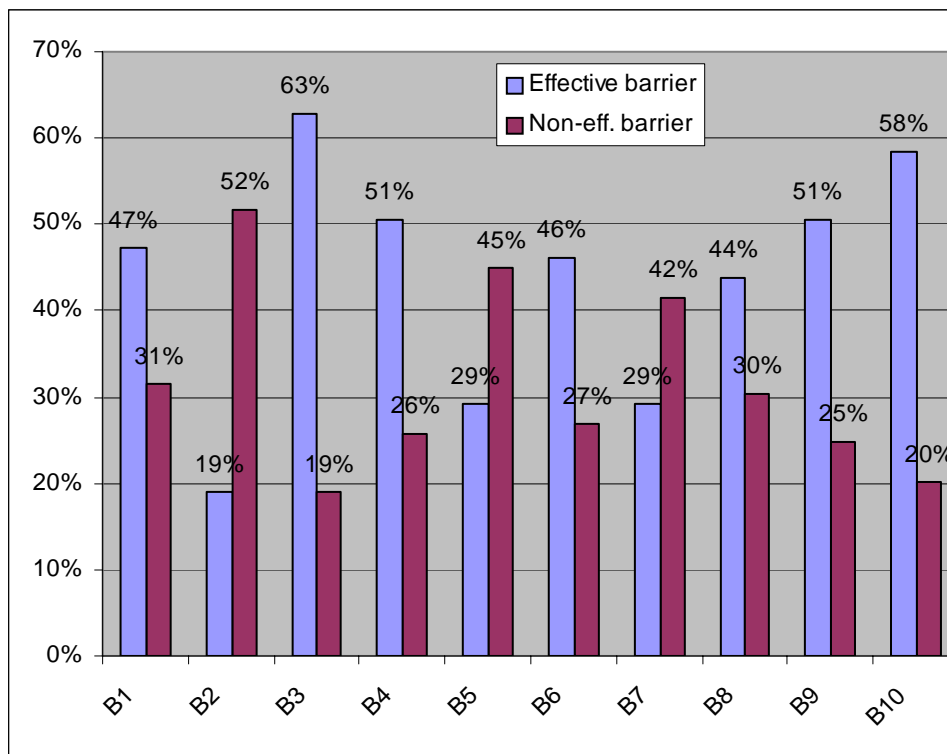


Fig.4 Perception of the effectivity of different barriers against knowledge sharing

Also the mechanisms that have effectively worked as KT in INR difficult period of '95-99 were studied, when a KM strategy didn't exist. Therefore, the benefic action of the identified factors (previously presented in the paper) was investigated (Figure 5).

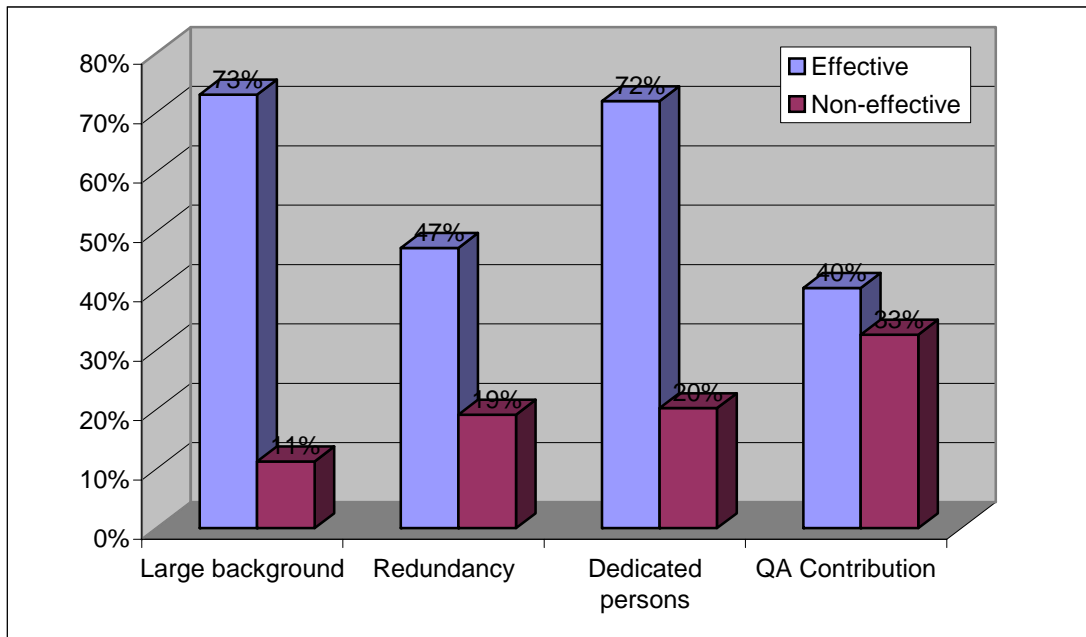


Fig.5 Perception of the effectivity of some factors that actioned for KT and KP in absence of KM

At the same time the importance of the following motivation increasing factors are measured:

- (I1) according retiring awards depending on the effective KT;
- (I2) increasing of salary in the last years depending on KT;
- (I3) clearance form completion only after relevant exit interview;
- (I4) post-retiring collaboration contracts depending on number and quality of the prepared newcomers;
- (I5) support for future publications;
- (I6) free access at INR social/team building activities.

An illustrative matrix of the importance of the retiring experts' interests is presented in fig.6.

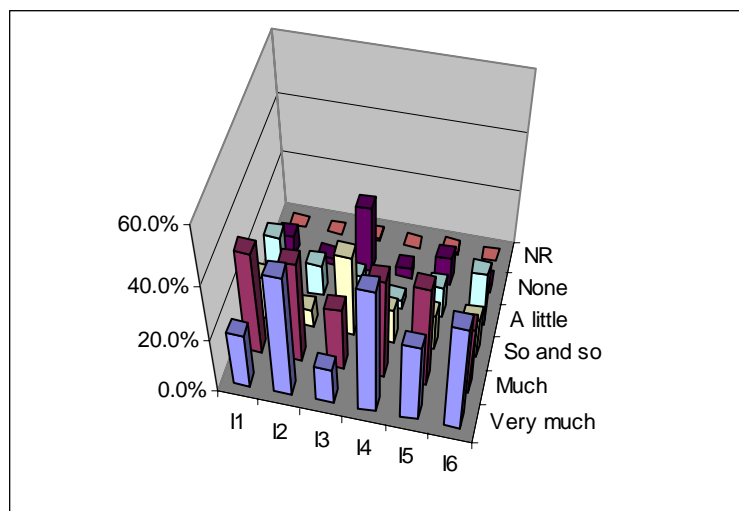


Fig.6 Matrix of interests- perception of the importance

We also explored the experts' intention to continue their present activities after retiring (63% said "yes" and 34% answered with "no"). For continuation the possible alternatives investigation is presented in figure 7.

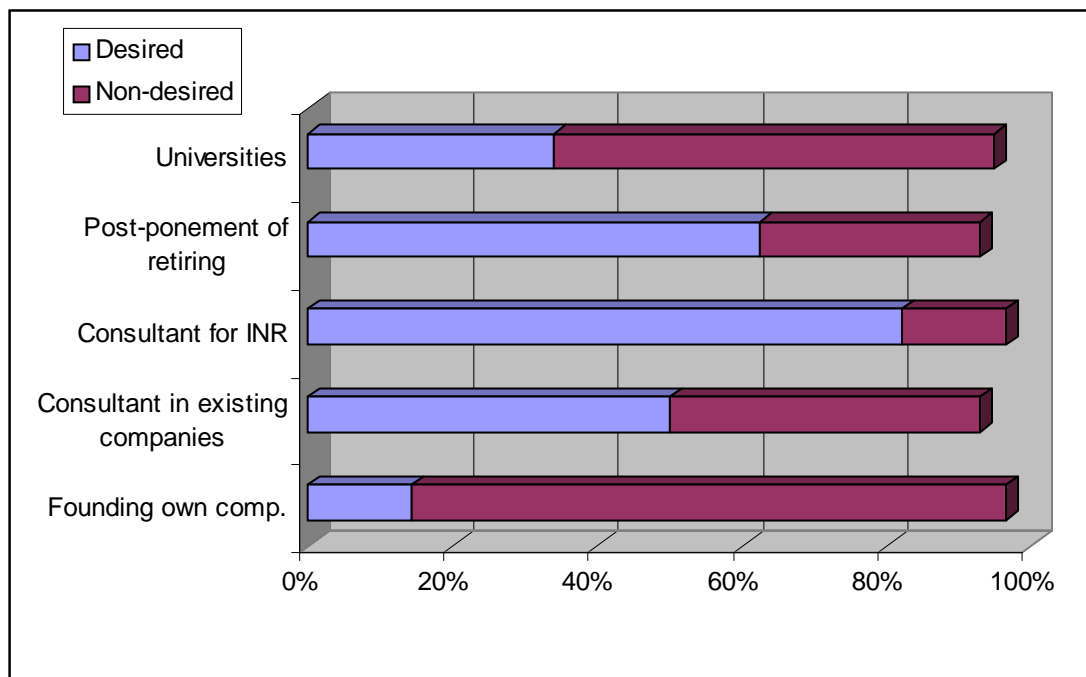


Fig.5 Perception of the effectivity of some factors that actioned for KT and KP in absence of KM

At the same time the importance of the following motivation increasing factors are measured:

- according retiring awards depending on the effective transferred knowledge (57%);
- according additional earning for KT tasks (80%);
- post-retiring collaboration contracts depending on number and quality of the prepared newcomers (81%);
- support for future publications (64%);
- free access at INR social/team building activities (63%);
- clearance form completion only after relevant exit interview (47%).

Our results will contribute to a the redefinition of the long/short term INR strategy taking into accounts the INR and retiring experts interests.

### **KM in INR for the next period**

The core of INR knowledge should be the ability to sustain the creation of organizational knowledge through learning and collaboration. Thus, in the last years INR was involved in many national and international projects in order to improve the experience in some expertise fields (severe accidents, radioactive waste management, innovative concept for GenIV, hot cells laboratories management etc.). INR is involved in FP6 projects including networks of excellence and in cooperation activities with institutes and organization from EU, Korea, Canada, USA. At the same time INR is involved in Romanian consortia with universities and research institutes in order to work in projects with funds obtained in national competitions. From our experience the international and national cooperation is a good method to exchange information, improve the own expertise, obtain and transfer knowledge.

In the following the main aspects of INR medium and short term strategy are presented.

Medium term strategy:

- intensify the collaborative processes.* This includes the implementation of rotation principle, community of practice and mentoring, for activities where the number of persons is less than 3.

*-collaboration with other institutes/universities.* This area includes researchers collaboration, INR researchers teachers in universities, student interships in INR, using community of practice at interorganizational level (communication and knowledge sharing, preparing newcomers, learning/teaching collaboration)

*-invest in people and knowledge.* This area includes the assessment of future market needs, trainings, involving in exercises and experiments, participation in conferences/seminars (including the conduct of the events) combining the communities of practice with building the expertise by learning/teaching/coordination

*-supporting infrastructure developments,* including the integration of collaborative networks and shared knowledge bases.

*-implement the best practices.* Development of informal networks of personal contact with NPP/universities/regulatory body/research institut/etc. personell.

*-maintaining the repository of explicit information as an alive and dynamic tool.* This area includes aspects like: knowledge identification, local and contextual, capturing, processing&organizing, storage, retrieval including interoperability, data exchange, transport mechanism, version control, updating, quality management.

Short term strategy:

*-hiring new personell* (generally young) in order to compensate the important loss by retiring (about 25% of actual personell) in the next 5-10 years;

*-selecting the candidates directly from universities* based on study contract (supported by INR) between students and INR;

*-the newcomers should be hired with at least 3 years before the retiring of the existing personell* in order to obtain an optimal transfer of the tacit knowledge;

*-obtaining national funds for KP* as a partial support for the preparing of young graduate newcomers in the nuclear research and nuclear industry activities; this requirement is based on the importance of the activity for science and industrial applications;

*-defining the collaboration policy* between retired researcher and INR; introduce in the policy the result of the harmonization process between INR and retired researchers interests;

## Conclusions

Predictible loss of experienced personell in INR for the next 10 years, mainly by retirement, requires countermeasures from the point of view of KP. Our strategy is based mainly on hiring young personell with at least 3 years before the retiring of the existing one and using community of practice at interorganizational level. The intention is to obtain an optimal transfer of the tacit knowledge. Strong collaboration in educational programme for universities, such the e-learning project developed with Politechnica University of Bucharest allows us to obtain a more rapidly adapted graduates at INR research activities. Taking into account the limited funds we intend to obtain national funds as a partial support for the preparing of young graduate newcomers. At the same time we want to define, more clearly, the collaboration policy between retired researcher and INR. We intend to introduce, in the community of practice context, the successor method. Anyway the key point is the motivation of the 'older expert' to transfer his knowledge to the 'younger newcomer'.

## REFERENCES

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