Overview of activities in knowledge management undertaken by AVN

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Abstract

This paper focuses on both Knowledge Management activities undertaken by AVN internally and activities undertaken towards the licensees.

Recently AVN adopted a framework for the implementation of Knowledge Management within AVN. With respect to the different aspects of this framework an inventory was made of past and on-going activities. It allows identifying aspects of Knowledge Management where further efforts are needed. This framework will be presented and examples of past and on-going activities will be illustrated. Examples will cover organisational aspects and aspects related to Research and Development. Also some recent activities that where developed will be described, focusing mainly on knowledge retention.

AVN is also involved in discussions on Knowledge Management with the licensee of the nuclear power plants and the main architect engineering company. Some of these discussions are performed in the framework of a specific subject within the Periodic Safety Review. AVN's experience from these discussions on methodologies presented by the licensee and its architect-engineer to set up and improve its knowledge management activities will be presented.

Actions are also undertaken by AVN towards the licensees through its inspection activities where engineers of AVN's Nuclear Installation Inspection Division have regular contacts with NPP staff during which knowledge management by the licensee is addressed. Examples of these actions towards the licensee will be described.

1 Introduction

In recent years, knowledge management has received increased attention, not the least in the nuclear industry.

As Authorised Inspection Organisation for the Belgian nuclear installations, in particular all nuclear power plants, AVN developed activities in this field both internally and in relation with the Belgian Licensee (Electrabel) of the nuclear power plants and its main architect-engineer (Tractebel Engineering).

This paper gives an overview of these activities.

2 Knowledge management within AVN

Within AVN's missions, inspection and safety evaluation of nuclear installations are at the forefront [1]. For such activities, knowledge and expertise have always been and will always be of primary importance.

Although certain forms of Knowledge Management (KM) have been applied since long time, KM came in recent years much more explicitly into focus as an important aspect of

managing an expertise company such as AVN. Both internal factors (reorganisations, retirements, ...) and external factors (changing environment in Belgian legal context, international activities, …) emphasized the need of a structured KM approach.

2.1 Framework for implementing KM within AVN

As mentioned in the introduction, KM is certainly not new for AVN. But its growing importance due to the changes in the industrial environment and ageing of personnel, and the related efforts undertaken by the international (nuclear) community encouraged AVN to integrate KM visions and activities in a structured framework.

The objective of this document is precisely to provide such an overall framework for the implementation of KM at AVN, and more specifically:

- to define clearly the different "building blocks" of a KM strategy
- to link past and existing activities at AVN within this framework

For achieving this goal, AVN was inspired by a framework developed in reference [2]. The framework is based on the identification of "Building Blocks of Knowledge Management" and is schematically represented in the following figure:

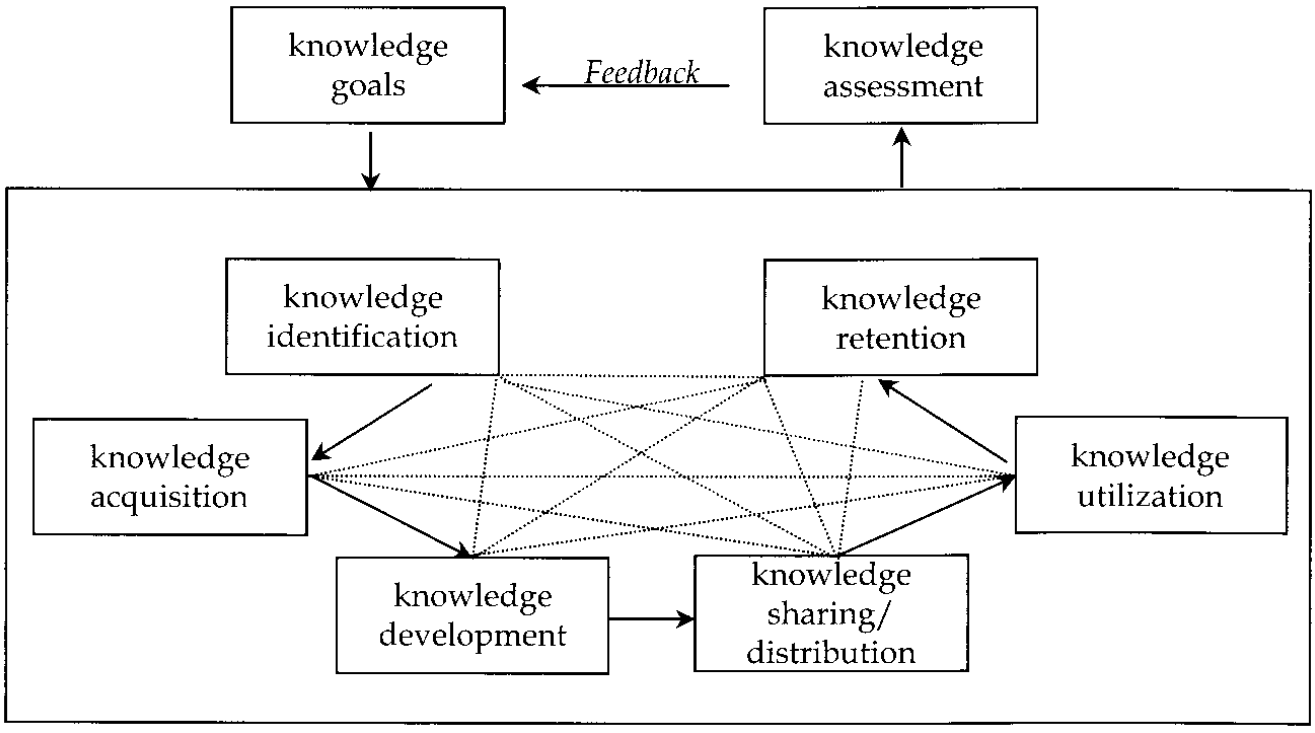

Figure: Building blocks of knowledge management [2]

2.2 Practices applied or under development at AVN

For a good understanding of the following description it is worthwhile to describe two pillars of AVN's organisation.

At one hand, AVN has 3 technical Divisions, respectively "Nuclear Installations Inspections", "Projects & Experience Management" and "Studies, Research & Development".

At the other hand, all technical staff is member of one or more Technical Responsibility centres (TRCs). These are non-hierarchical networks of (typically) 3 to 6 persons, active in a well-defined technical domain. The TRCs are responsible for developing and maintaining AVN's expertise in their domain. Each TRC lies under the responsibility of one of the technical Division Heads, who is accountable for the effective working of the TRCs under his responsibility.

2.2.1 Knowledge Goals

Normative goals have been set by AVN by defining its "Values" [3]. Some of them are intrinsically linked to KM, as there are "Maintain its competence in nuclear safety and radiation protection" and "Continuously optimise the dynamics of a multidisciplinary team". These normative goals are intrinsic to the mission of AVN.

Strategic knowledge goals on KM are defined for instance in the annual objectives of the divisions. Also the R&D strategy and the yearly R&D Programme are fundamental in defining strategic KM goals.

Operational KM goals are then further developed within the divisions by translating strategic goals into (yearly) objectives for TRCs or specific persons, within the performance of the R&D tasks and by defining the yearly training programme.

2.2.2 Knowledge identification

At AVN no explicit operational tools exist that allow to identify easily "who is expert in what".

Some documents go in this direction but they cannot be used as a searching tool. An example is the form "Follow-up and maintenance of individual expertise" developed within the Quality Management System (QMS).

Also organisational documents of the TRCs (such as the TRC ID Cards) give some inventory on "who is expert in what", but also these documents have no easy search possibilities.

Nevertheless, AVN being a small company, the need of explicit operational tools in this area is smaller than, for instance, in multinational companies.

Knowledge identification also covers the aspect of identifying what knowledge or competency could be needed in future. A reflection on knowledge identification is part of the yearly discussion of the R&D Programme and, on a longer time scale, of the discussion of the R&D Strategy. Also the TRCs are asked to pay attention in their Annual Reports to the aspect of new needs for knowledge development.

Knowledge identification is also a continuous point of attention within the AVN Steering Committee (General Managers + Division heads).

Contacts with think-tanks (university departments, companies staying close to new technologies and theories, …) might be interesting for knowledge identification. At this point, AVN has always had an open minded approach: several persons maintain links with Belgian universities by giving lectures or by being involved in research activities; membership of working groups of engineering societies, etc.

2.2.3 Knowledge acquisition

An example from the past of knowledge acquisition is the AVN participation (together with 5 other regulatory organizations) to the PSA Based Event Analysis project. Instead of developing the PSAEA methodology and procedure on its own, AVN decided to pass a contract to an external consultant (together with 5 other regulatory organizations) to make an overview of existing practices and methodologies and to provide a procedure for conducting such PSAEA-analyses. This PSAEA-technique is now incorporated in the operational feedback process at AVN. It can hence be considered as a successful example of knowledge acquisition, although (before becoming operational) it was complemented by internal knowledge development (see further in § 2.2.4).

Another example of knowledge acquisition is the effort undertaken to develop a procedure for analysing the human factor aspects in incident investigations. As a first step in the implementation of this plan, contact has been made with an external consultant having practical experience in the field of HF-analyses in the nuclear industry. The objective was to have external support for the definition of a HF approach at AVN, to provide general HF-training inside AVN and to provide assistance in the development of an incident investigation method, adapted to AVN's needs, in which HF-analysis should be fully integrated. Later this effort has also been complemented by internal knowledge development (see further § 2.2.4).

A recent example of knowledge acquisition applied by AVN is the involvement of 2 external "interim managers" for developing and implementing the QMS.

Another form of external knowledge acquisition can be realized through cooperation under various forms with other companies or institutes. A recent example consists in the discussions between AVN-GRS-IRSN on a Safety Assessment Guide. This SAG requires that all safety analysis work be independently reviewed. It was noticed that for some very specialized domains no internal "redundant" expert could be available to perform this independent review. In such a case, the idea was forwarded that the independent expert for review could be delivered (e.g. to AVN) by an outside organization (GRS or IRSN). This is a form of knowledge acquisition by cooperation.

2.2.4 Knowledge development

In § 2.2.3, PSAEA is given as an example of knowledge acquisition within AVN. However, after the development of the PSAEA-procedure by an external consultant, the technique was tested out and optimised by including this activity for a few years within the AVN R&D programme. PSAEA is hence a successful example of combining knowledge acquisition and knowledge development.

In § 2.2.3, the use of external support for developing an approach to consider HF-aspects in incident investigation is given as an example of knowledge acquisition within AVN. In a later stage this effort was complemented by further development within the AVN R&D Programme.

Presently, an important contribution to knowledge development within AVN comes from the R&D activities. It is important to keep a link between strategic knowledge goals on KM (see § 3.2.2) and the R&D strategy and the yearly R&D Programme.

A contribution to knowledge development can be obtained from reflections on past work, trying to identify "lessons learned" and related improvements for future. This aspect has been applied in the past by AVN for major projects (e.g. steam generator replacement

projects) for which a post-project debriefing was organized. This practice has been formalised in the quality system and is now applied to all projects.

An important issue of knowledge development is that it should be developed by teams, not by individuals. Within AVN, the TRCs (see introduction to § 2) have an important role to play in this respect.

2.2.5 Knowledge sharing and distribution

An objective of sharing and distributing knowledge is to create certain redundancies in intellectual assets. Within AVN, the TRCs have to play an important role in this objective. They have the advantage that they are running horizontally (throughout the AVN-structure) without being directly linked to hierarchical pathways. In this way, the TRCs fulfil the role of what is often called "centres of competence".

Company manuals, whether computerised or in traditional form, are still an indispensable source of information in many companies. A series of documents that were issued mid-2003 are important examples of how knowledge on safety assessment and rulemaking can be shared amongst the whole personnel. Later, they were integrated in the QMS.

Also "socialization" of some type of information (the organisation's norms and values, communicating basic behaviours, "teaching" company culture…) is necessary. Within AVN, the monthly Sandwich-debates provide a forum for sharing information of different kind amongst the complete personnel.

2.2.6 Knowledge utilization

On the organizational side, the TRCs play a primary role in utilizing the available knowledge and competencies in daily activities of inspection and safety assessment.

At this moment, an Electronic Document Management System (EDMS) is being implemented at AVN, which will bring an added value to utilization of interesting information and knowledge, by providing enhanced ways of archiving and retrieving valuable material.

2.2.7 Knowledge retention

Especially in the nuclear engineering and safety assessment domain, knowledge retention is becoming an important issue. This has to do with retirement of people who were involved in designing and commissioning installations and with the fact that acquiring young engineers with a basic training in nuclear engineering has become difficult.

Also at AVN retirement of staff and the corresponding retention of their knowledge is an issue.

At a recent retirement of a staff member who had been in charge of a specific (highly specialised) domain the idea was taken up to charge a young engineer to make a structured inventory of past projects and to identify major issues and lessons learned from these past projects. This is a contribution to knowledge retention. Also the fact that the retired engineer continues to work part-time for AVN gives possibilities for knowledge retention via discussions with the people who took over the responsibilities for this technical field.

AVN has elaborated a few years ago a "R&D History" file (one of them on closed projects) aiming at preserving the experience with closed R&D projects, mainly on its management and its outcomes. This is also a form of knowledge retention.

In the framework of the recently introduced QMS, the process A06 "Providing expert services in nuclear safety and health physics" aimed to introduce better and more structured reporting on safety assessments. For this, different templates of structured documents on work requests and the corresponding reporting are now in use. This should also be beneficial for knowledge retention by allowing better retrieval of safety assessments documentation (combined with the introduction of the new EDMS).

In 2005, a start was made to test an approach for knowledge retention with some engineers foreseen to retire in about 5 years. Through interviews, attention was devoted to aspects such as identification of their knowledge, the need for keeping this knowledge and on how to transfer the knowledge to other staff. The synthesis of these interviews revealed a number of main ideas on how this knowledge retention should be conducted in practice: not every knowledge and experience can and must be transferred from one person to another, the availability and use of retrievable knowledge is an essential element for knowledge retention, it is important to transfer holistic views on safety in order to maintain a common general understanding and philosophy of safety, the needed operational knowledge of the organisation should be known and adapted to future needs, on-the-job training is an important aspect of the coaching of the younger staff, a senior expert should transfer the responsibility for a technical domain to a younger staff member so that the latter can take ownership. It was also recognised that the whole staff needs to consolidate its knowledge on a daily basis and the TRCs play an important role in this activity.

Two senior experts have applied the established knowledge retention procedure to their TRCs. They have proposed, among others, the technical domains for which a transfer to other staff is needed, if not yet on-going. This approach will be further developed in the future.

2.2.8 Knowledge assessment

Since a few years, the TRCs are asked to write every year an "Annual report", which is addressed to the Division Head responsible for that TRC and the person in charge of the overall QMS-process of TRC management and operation. In this report the TRCs are asked to evaluate the functioning of their TRC, with consideration among others to training, new field of competencies or activities to be developed, need for development of tools, need for better documentation, coaching needs, and improvements of exchange of information or knowledge within the TRC. This Annual Report is discussed between the TRC Coordinator, the Division Head responsible for the TRC and the process coordinator. It contributes in this way towards knowledge assessment within AVN.

Another example of knowledge assessment is the yearly evaluation of the training programme. It gives an overview of the "volume" of training in hours and the costs (direct costs and equivalent work hour cost), a qualitative analysis (appreciation, assimilation, incidence on personal work efficiency) of the training received and the internally given training, a qualitative evaluation of the sandwich debates, and presents finally the conclusions.

3 Discussions on KM with the Licensee

As Authorised Inspection Organisation, AVN is also involved in discussions on Knowledge Management with the Licensee (Electrabel) of the Belgian nuclear power plants and its main architect-engineering company (Tractebel Engineering). These discussions are

taking place within the Periodic Safety Review (PSR) of the NPPs and through our inspections at the NPP sites.

3.1 KM aspects within the Periodic Safety Review

Presently, some common subjects are being under investigation for all plants within the framework of the Periodic Safety Review. One of these subjects is related to the documentation and knowledge of the design basis of the NPPs.

When defining this subject of the PSR, the main concern was that all safety related aspects of the design need to be anchored and accessible in order to ensure in the long term that operating, maintaining and modifying the installations can be performed without endangering the original and present safety level.

Practice from past studies and projects learnt indeed that some documentation on the original design, complemented during past projects, was sometimes difficultly traceable. In addition, many experts that took part in the design have come to the retirement age.

In accordance, a methodology was set up to investigate this matter and to foresee the appropriate actions, where needed.

A first step in the methodology consists in identifying the knowledge needs related to the design basis. For responding to this, Tractebel Engineering (TE) developed a Knowledge Map, allowing to define critical domains where good knowledge of the design basis is crucial. Expert interviews contributed largely in accomplishing this task.

As a second step, a structured method was developed by TE to perform a “Risk analysis”, with, as objective, to identify those critical domains were actions seem warranted to improve documentation or knowledge sharing.

Finally, approaches were defined to improve documentation or knowledge sharing, where needed. These approaches are being applied to some pilot projects and an evaluation of the results is foreseen later before more extended use of the developed methodology.

Within the same subject of the PSR the Licensee is also presenting the Knowledge Management programme developed within its organisation. This covers organisational aspects for a better management of knowledge as well as methodological aspects for specific aspects of KM. Examples of initiatives are related to knowledge retention (from retiring people, in case of job rotation, etc), “After action review” evaluations (providing lessons learned from main activities and important projects), setting up Communities of Practice, and application of the Knowledge Map (see also above). These initiatives are then discussed with AVN, partly in respect to the observations made by AVN in its daily inspections (see § 3.2).

3.2 Attention to KM aspects through plant inspections

Management activities are a subject of thematic inspection organized with the most important managers of the NPPs. Among them, knowledge management has received particular attention given important changes recently made by the Licensee.

Recently the Licensee of NPP has made some important changes to its organisation. During the inspection activities related to these organisational changes, several topics on KM were discussed. As a consequence of the changes in organisation, some of the plant personnel changed from one function to another. In order to ensure that losses of knowledge would be limited as much as possible, the inspectors required from the

Licensee to demonstrate that adequate plans were in place to provide for a smooth transfer of knowledge. In response to this requirement, the Licensee introduced a systematic knowledge transfer system, supervised by the management, intended to provide for an appropriate support to ensure that essential knowledge is transferred. The management provides adequate resources in order to give time to allow the process to take place.

Another example of particular interest to KM can be found in the inspection activities related to the changes made in the organization of maintenance activities. During the discussion of this project, aiming at sharing more extensively maintenance personnel within the Licensee's company, it appears clearly that the level and extension of competence for this personnel had to be more clearly and precisely defined than in the past. In response to inspections requests, the Licensee set up a comprehensive competence management system, defining, for each function or set of activities, the necessary skills and knowledge. Detailed "competence cards" have been established allowing to check the capabilities of the existing maintenance personnel. This checking exercise allows to identify possible lacks in knowledge and to provide for complementary training and drills.

4 Conclusions

Given the importance of knowledge management within the nuclear industry, growing activities are being undertaken by AVN in this field. Indeed, as Authorised Inspection Organisation for the Belgian nuclear installations, in particular all nuclear power plants, inspection and safety evaluation of nuclear installations are at the forefront. For such activities, knowledge and expertise have always been and will always be of primary importance.

Consequently, AVN has developed KM activities both internally and in relation with the Belgian Licensee of the nuclear power plants and its main architect-engineer.

Within AVN, an inventory of past and on-going activities has been integrated in a knowledge management framework. The evaluation of how AVN's activities are situated with respect to this framework can be a useful tool to define further actions for improvement of AVN's KM efforts in a coordinated fashion.

Further, concerning the inspections and safety assessment of the nuclear installations, knowledge management is also dealt with. At the installations, this is mainly achieved through our inspections; for the safety assessment aspect, it is mainly covered through the Periodic Safety Review.

5 References

[1] AVN Annual Report 2004; available on AVN's website (www.avn.be)

[2] "Managing Knowledge – Building Blocks for Success"; G. Probst, S. Raub and K. Romhardt (2000) (Ed. John Wiley & Sons; ISBN 0-471-99768-4)

[3] AVN-website (www.avn.be)