CLUB
GESTION DES
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Part 1
Introduction

1.1
Background

The way to a worldwide standardisation is now open for KM. Since 2015 the ISO 9001 standard includes, a part dedicated to KM (ISO DIS 9001 § 7.1.6). The requirements in that version are well known by KM practitioners:

- Identify the required knowledge necessary for the business processes and the conformity of products/services
- Maintain and disseminate knowledge
- Identify how to acquire or to access to required extra knowledge

In the nuclear domain, the last version of the international "Safety Standards" elaborated by the IAEA (International Atomic Energy Agency) includes KM as a requirement for safety in the nuclear organisations.

The Club Gestion des Connaissances, after nearly 20 years of KM practices by its members and the patient construction of a KM set of operational tools, has the ambition to contribute to that standardisation impulse. Its project is to provide to its members with standard methodological guidelines, to support KM objectives and implement a KM plan in any organisation. This document is based on:

- The results accumulated by the Club Gestion des Connaissances since 1999.
- The report elaborated since 2014 by IAEA (International Atomic Energy Agency), a UN organisation that is responsible for international Safety Standards in the nuclear domain, entitled "Knowledge Management for Safety Regulators", with the participation of several countries all over the world.
- The coordination and the research results accumulated by Jean-Louis Ermine since 1985, with his different collaborators in Université de Bordeaux, Commissariat à l'Énergie Atomique (French Atomic Energy Commission), Université de Technologie de Troyes, Institut Mines-Télécom. Jean-Louis was president of the Club Gestion des Connaissances from 1999 to 2016, and is currently KM expert for IAEA and other organisations.

1.2
Objective

The objective of the publication is to provide guidance on how to plan, elaborate and maintain an effective knowledge management programme. It focuses on practical applicability of the guidance provided, achieved by short and concise descriptions of all relevant knowledge management processes.

1.3
Scope

Fortunately, Knowledge Management is not a new idea. Since the very beginning, any company manages its knowledge and its know-how, eliciting them with the help of documents and procedures, disseminating them for example via training, organising exchanges of any form with their collaborators. Nowadays, there is a new dimension, which is the strategic dimension of knowledge, as resource of competitiveness, performance and risk prevention. It requires, in the company, a global, conscious and reasoned approach for managing its knowledge capital. It is a long-term process to be achieved progressively, starting from the previous Knowledge Management steps already implemented in the organisation, enlarging their scope, focusing on strategic issues. Innovation has to be performed in that domain to increase the added value of Knowledge. It is also a cultural change that must appear gradually in daily work, and not like a revolution that must change everything. It is an action for continuous progress.

In the present document, the question of using Knowledge Management methods for knowledge risk prevention and strategic knowledge development is addressed. A comprehensive framework is sketched for implementing Knowledge Management with the so-called "MASK approach" (Methodology for Analysing and Structuring Knowledge). This approach is a knowledge centred approach based on the Knowledge resources of the organisation. Other approaches can be considered, for instance, process centred, people centred or IT centred. A knowledge centred approach implies a clear representation and management of the Knowledge resources of the organisation.

Part 2
Definitions and concepts

2.1
Terminology

Capacity	*Integration of a set of individual competences in order to achieve the strategic goals of the organisation*
Competence	*Accumulation of experience by putting in practice, individually and efficiently knowledge in an operational activity in order to achieve required objectives.*
Critical Knowledge	*Knowledge domain that is crucial for the organisation and that may be threatened for different reasons*
Critical Knowledge Assessment	*Process of identifying the critical knowledge domains of the organisation, based on interviews of knowledgeable people and a set of critical knowledge factors*
Data	*Results of the process of perception of the reality from sensors (natural or artificial), and given in the form of non-interpreted raw facts.*
Explicit knowledge	*Knowledge that has been formalised or has already been codified in some form such as manuals, procedures, databases, or electronic media.*
Information	*Structured set of data. The terms used in that structure are understood by professional of the domain. Knowledge Book*
Knowledge Book	*Document resulting of the elicitation of some critical tacit knowledge (individual or collective)*
Knowledge Resources	*All the resources (e.g. tacit or explicit knowledge, knowledge networks, information systems, documentation ...) that contribute to the effectiveness of knowledge put in action.*
Knowledge Codification	*Process that transforms tacit knowledge into explicit knowledge.*
Knowledge Creation	*Process that generates innovative knowledge based on collected information, interactions between actors, feedbacks from activities, inputs from R&D*

Knowledge Management Plan	*Document that maps all the knowledge domains involved in the organisation's activities, and that lists all the necessary actions to organise knowledge resources, codify tacit knowledge, share, acquire and create knowledge.*
Knowledge Management Strategy	*A concise, high level and organisation specific statement that clarifies objectives, responsibilities and roles, timelines and internal communications, resources, and other topics of interest to be considered.*
Knowledge Management	*An integrated systematic approach to manage knowledge: identifying, sharing, acquiring, and enabling groups of people to create new knowledge collectively to help in achieving their objective.*
Knowledge Map	*A graph representation of the different knowledge domains involved in the activity of the organisation.*
Knowledge Processes	*Processes that have knowledge as inputs and/or outputs, and that participate to knowledge transformation.*
Knowledge Search	*Process of knowledge acquisition from external or internal information sources.*
Knowledge Value Chain	*Set of transformations of knowledge that brings value to the company.*
Knowledge	*Structured set of pieces of information linked by a cognitive model, (explicit or not), that put them into context and that is justified.*
Tacit Knowledge	*Knowledge held in the mind of individuals and often unspoken and difficult to formalise, share or transfer. It is rooted in practice, experience, intuition, judgement and individual skills...*

2.2 *Acronyms*

IAEA	*International Atomic Energy Agency (Atoms for Peace and development within the United Nations)*
CKF	*Critical Knowledge Factors*
CEO	*Chief Executive Officer*
CKO	*Chief Knowledge Officer*
CoMM	*Community Maturity Model*
DIKCC	*Data, Information, Knowledge, Competence, Capacity*
ISO	*International Standard Organisation*
IT	*Information Technology*
KBI	*Knowledge Based Innovation*
KCF	*Knowledge Competency Framework*
KM	*Knowledge Management*
KMM	*Knowledge Maturity Model*
KSA	*Knowledge, Skills and Attitudes*
KVC	*Knowledge Value Chain*
MASK	*Methodology for Analysing and Structuring Knowledge*
PMI	*Project Management Institute*
UN	*United Nations*

2.3 The Knowledge Pyramid and the Knowledge Value Chain

2.3.1 The Knowledge Pyramid

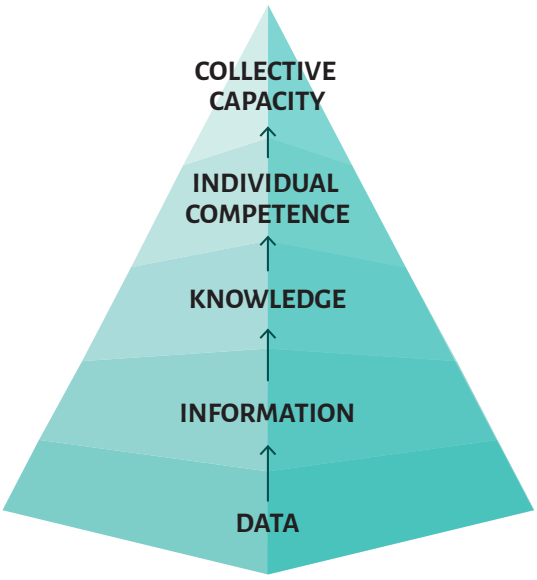

Figure 1: The Knowledge Pyramid

The main concepts used in KM can be understood in the well-known pyramid called "Data, Information, and Knowledge". This model is one of the most famous and commonly used models in the information and knowledge literature. Although it is widely used in information and knowledge management, this model remains rather 'loose'. We have amended this model with two additional layers to also include individual competence and collective capacity, and become the DIKCC model. Figure 1 shows the different layers of the building of knowledge from data up to capacity, and the different steps of transformations of a layer into the following layer.

In the following lines, simplified but sound definitions of the different levels are given that are necessary to understand the whole KM process: Those definitions have been elaborated thanks to a survey of the considerable amount of literature available on the subject.

Data

Data is made up of raw facts, not interpreted, that are the results of a process of perception of the reality through sensors (natural or artificial).

Information

Information is a structured set of data. The terms used in that structure are understood by professional of the domain.

Knowledge

Knowledge is a structured set of pieces of information linked by a cognitive model that put them into context and that is justified. Usually, the cognitive model is tacit then knowledge is essentially personal. Sometimes the model can be explicated and shared.

Knowledge is a very polysemic term, with many meanings, in a lot of different domains. We give some general meaning concerning terms which make a consensus in the KM world.

- Knowledge is a mix of experiences, values, contextual information and expert insight for acquiring, understanding and interpreting information.
- It means: to be familiar with something and can include facts, descriptions and information acquired through experience or education. It can refer to both the theoretical and the practical understanding of a subject.
- Knowledge, being polysemic, is often separated in different categories. The two main categories are the following:
- Tacit Knowledge: tacit knowledge is the knowledge held in the mind of individuals and is often unspoken and difficult to formalise, share or transfer. It is rooted in practice, experience, intuition, judgement and individual skills. However, it may be partially transferred from individual to another individual using different tools and methods. The consensus amongst knowledge management professionals is that most of the knowledge in any organisations is tacit.
- Explicit Knowledge: explicit knowledge is the knowledge that has been formalised or has already been codified in some form such as manuals, procedures, databases, or electronic media. It is knowledge that can be easily expressed in documents

Competence

Competence is accumulation of experience by putting in practice, individually and efficiently knowledge in an operational activity in order to achieve required objectives.

Competence is the combination of knowledge, skills and attitudes (KSAs) needed by a person to perform a particular job. All three are important and interrelate.

- Skill is the learned capacity to perform a task to a specified standard.
- Attitude is the feelings, opinions, and ways of thinking, perceptions, values, behaviour and interests of an individual, which allow a job or task to be undertaken to the best ability of that individual. Attitudes cannot wholly be taught directly and are partly a consequence of the organisational culture

Capacity

Capacity is the integration of a set of individual competences in order to achieve the strategic goals of the organisation.

Capacity is the ability to perform actions. We consider capacity as high level of competence in organisation level. It is the outcome of knowledge integration, complex, team-based productive activities and dependent upon company's ability to harness and integrate the knowledge of many individual specialists.

One of the challenges addressed by KM is to transform competences into capabilities. This supposes having a vision and a strategy in terms of what the organisation aims to achieve and to establish how the organisation will align to this vision

- A strategy is a particular long-term plan for success.
- Alignment, which is a proper or desirable coordination or relation of components, is the adequate tool as integration or harmonisation of aims, practices, etc. within an organisation.
- A vision is an unusual competence in discernment or perception, an intelligent foresight.

Capacity Management ensures the global capacity of innovation of the company, as a change (incremental or radical) of thoughts, products, processes or organisations, adequate to the objectives and the environment. It leads to creative and connected organisation. Ultimately, it also supports the organisation in becoming more agile, hence achieving greater resilience.

2.3.2 The Knowledge Value Chain

The Knowledge Pyramid and the corresponding definitions are fitted to build a "Knowledge Value Chain" (KVC) The KVC gives a KM framework to analyse the added value brought by each KM process implemented in the company.

The Knowledge Pyramid is the support of a KVC, considering that each level of the Pyramid is the output of a transformation of the lower level . The KVC is then a chain of successive transformations of data into information, information into knowledge, knowledge into competence, and competence into capacity. The added value is calculated by the value added in each transformation, according to the nature of each transformation.

To define more precisely the transformations in the Knowledge Pyramid we briefly define the transformation chain : The starting point of the transformation chain is reality, as a set of things possessing actuality, existence or essence, which exists independent of human awareness.

1. Transforming reality into data is acquiring signs (signals) through perceptive filters via observation
2. Transforming data into information is coding data trough conceptual filters via a structuring activity
3. Transforming information into knowledge is building models through theories via learning
4. Transforming knowledge into competences is implementing a set of practices through action via experience
5. Transforming competences into capacities is building a strategy (knowledge strategy) through strategic filters (alignment) via a vision

A pragmatic approach with an operational tool of that KVC is given in the corresponding annex.

***ANNEX:** KM Added Value*

2.4 A model for implementing a Knowledge Based Approach for KM

A Knowledge Based approach for KM relies on in-depth analysis of the company's Knowledge Capital, i.e. what are the opportunities and threats attached to the different Knowledge Domains, and what are consequently the means (organisations, methods, tools) to be implemented in order to develop the opportunities or reduce the threats for the concerned domains. It devises and installs the organisation, the methods and the tools that will consistently address the opportunities and tackle the threats of each domain. The ultimate objective is to allow the organisation to minimise its risks and achieve it knowledge capital. To attain this, we need to establish the a comprehensive set of processes that will cover all the areas where KM is a stake.

A possible model is given by the « Daisy Model » *(Figure 2)*, which defines and details the key processes for Knowledge Management.

Some processes are purely internal, as capitalisation and sharing, or creativeness and learning. Other are mainly external, as environmental scanning, that must start from the internal knowledge and feed it back, or as customer relationship, marketing that acts like a filter on the immense potentialities of creation and evolution of knowledge in the companies.

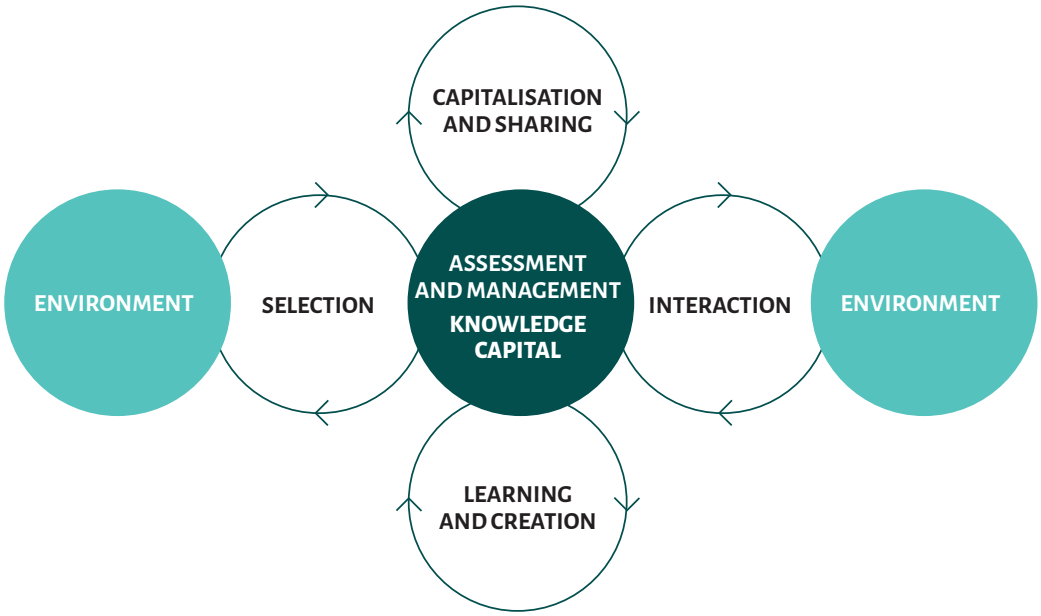

Figure 2: *The Daisy Model: Key KM processes*

Knowledge Management is the management of these processes, and especially the management of their link to the company's Knowledge Capital. One can describe them in four generic classes that correspond to the «petals» of the daisy and a class that corresponds to the heart of this model:

- ***The capitalisation and sharing process.*** It achieves the "virtuous knowledge cycle" and assures the dissemination (the « recycling ») of the knowledge resources in the company.
- ***The process of interaction with the environment.*** A system disconnected from its environment is a dead system. It is especially true for knowledge, fed by more and more important information flows that come from the environment of the company. The process transforms these flows of information into knowledge, useful to the company. It is, for instance, the processes of environmental scanning, economic or strategic intelligence (« Business Intelligence »). Up to now, this kind of processes is currently based on external information processing, and not on the interaction with the knowledge of the company.
- ***The learning and creation process.*** It is an endogenous and collective process, which is the basis of knowledge evolution. It includes the issue of the learning organisation and of the creativeness.
- ***The process of selection by the environment.*** It is an evolutionist process, selecting created knowledge, according to criteria based on market, on acceptability etc., both economic and socio-technical. It includes the issue of marketing, of customer relationship... The problem of Knowledge Management is to integrate this type of issue in strong relation with the crucial knowledge of the enterprise, especially professional knowledge, for example.
- To this set of processes, one can add a fifth one which is evaluation. It is a requirement to assess the relevancy and adequacy of the processes that form that Knowledge Based approach. This fifth process concerns the evaluation of the all the rest. It measures how effective the approach is, but also the possibility to take corrective actions. It is the assurance that the organisation fully realise the potential of its Knowledge Capital

2.5
A set of Knowledge Management processes

P1: Create and learn

P2: Share the knowledge and ensure its application
- ***P2.1:*** Share the knowledge
- ***P2.2 :*** Ensure the knowledge application

P3: Capitalise the knowledge
- ***P3.1:*** Formalise and capitalise the operational knowledge *(produced through an operational process)*
- ***P3.2:*** Formalise and capitalise the domain knowledge *(of a specific domain or from an expert)*

P4: Manage the company's Knowledge Base
- ***P4.1:*** Ensure the relevancy of the capitalised knowledge
- ***P4.2:*** Select the knowledge in accordance with company's environment evolution.
- ***P4.3:*** Manage the content of the company's Knowledge Base

P5: Define and supply tools and elaborate the rules for their use
- ***P5.1:*** Define and supply methodological tools
- ***P5.2:*** Define and supply numerical tools
- ***P5.3:*** Define and apply rules (privacy policy, roles and responsibilities, ...) for the utilisation of tools

P6: Monitor the KM System
- ***P6.1:*** Define KM policy and goals
- ***P6.2:*** Assess the KM System performances
- ***P6.3:*** Define and monitor a KM improvement project
- ***P6.4:*** Supervise the KM system (Decision process, Management process, ...)

In the Daisy Model, we identified four internal processes: "Create and learn", "Share", "Capitalise", and "Select". To develop and support Knowledge Management throughout the company, this set of process has to be completed and organised to constitute the KM System.

Setting up a sustainable KM system relies on a set of processes well integrated with company's processes. KM processes are part of company's processes baseline. They are mainly support processes, but some of them are operational processes.

For example, at the beginning of a design process, usually a first task consist in gathering required knowledge, mainly in terms of reuse of models, concepts, methods, best practices, etc. This is a part of the "Share" process. At the end of this design process, a there is task consisting in complementing the knowledge capital or at least giving the required information to do that. This is part of the «Capitalise» process, which encompasses also tasks like capturing and formalising expert's knowledge (ex: when retiring).

There is no separation between the different processes. When people, working in a design process, share knowledge to do their work, they also create and learn new knowledge.

A possible KM system is given by the set of processes described in this paragraph, which defines and details the key processes for Knowledge Management.

Part 3
From KM strategy to KM implementation

Process : P6: Monitor the KM System
Subprocess: P6.1 Define KM policy and goals

A good starting point for implementing KM in an organisation is to elaborate of a concise, high level and organisation specific KM strategy. Issues to be included in that strategy are given in the Annex:

- Objectives,
- Responsibilities and roles,
- Timeline and internal communication,
- Resources,
- Links between KM and other processes,
- Link to national context,
- Other topics of interest to be considered.

3.1
Who are the Stakeholders

The KM strategy should involve or address the different stakeholders, for instance:

- **Internal stakeholders (at different levels):**

  Vision:

  - The Chief Executive Officer (CKO) and his Executive and Management Committees,
  - Other Steering Committees (Innovation, Improvement…),

  Steering:

  - Top Management,
  - Senior Management,
  - Middle Management,

  Implementation:

  - Product Line management,
  - Project Management,
  - Head of functions,
  - Employees,

- **External stakeholders :**

  - Customers,
  - Suppliers,
  - External organisations with KM practices (for benchmarking and process evolution)…

External stakeholders should not be forgotten. Depending on the level of interaction the organisation have with its external stakeholders; it is a key question to ask ourselves to what extent they will influence the realisation of the Knowledge Strategy. When there is a potential (by streamlining knowledge exchanges for instance), it should be systematically addressed. This could take the form of establishing mutual objectives and controls.

It is quite important that all internal stakeholders do agree on the KM strategy but also ensure a sufficient level of support and traction from the different stakeholders:

- **Usually at Top Management level, KM is accepted. However the level of up varies between individuals.**
- **What could be the message transmitted to or understood by the Middle Management :**

  - Depending on the level of discrepancies, it could be "I should wait until they agree", and nothing will happen,
  - The Middle Management is sensitive to precise work objectives, it is needed to achieve successfully organisation's projects, and their career progress is directly depending on fulfilling these objectives, so they need strong arguments to agree on doing KM activities.

Finally, one of the key success factors for involving stakeholders lies in the capacity to create visible outputs and provide tangible outcomes that serve their needs. That is how we get the necessary buy-in which ultimately creates to the momentum to sustain the strategy

3.2
Establishing a KM framework

Dealing with important critical issues of loss of knowledge through attrition, retirement and generation change or outsourcing, preserving knowledge of key experts and knowledge transfer have attracted a lot of attention and efforts in developing new approaches and methodologies, especially in case of complex areas of special expertise and skills accumulated after many years of activities.

Complex organisations rely heavily on knowledge, and their activities depend on the availability and the good management of this knowledge. Applying systematic KM practices in organisations has proven to be necessary for maintaining competence and skills for achieving high level of performance. That is why these organisations have to implement a comprehensive KM plan, as a fully integrated system.

Knowledge management is being addressed as a component of an Integrated Management System. Therefore, a prerequisite of any strategic knowledge management plan in an organisation is to establish a KM framework.

This section provides a sketch of such a KM Framework

▸ Management responsibility

- ***Supporting knowledge management initiative***
  It is suggested that the level of support should be the CEO (Chief Executive Officer) and his Executive or Management Board. The support should be also strongly communicated to all levels of the organisation, to leave no place to ambiguity: the whole organisation must know that KM is an essential objective of the CEO.
- ***Appointing the CKO (Chief Knowledge Officer)***
  It is suggested to first appoint a senior manager as Chief Knowledge Officer (CKO), in charge of establishing the KM strategy, identifying the appropriate resources to elaborate, implement, monitor and evaluate the KM plan, and reporting directly to the CEO and his Executive or Management Board.
- ***Involving the Managers as Knowledge Managers***
  Managers have to be mandated as being in charge of the part of the Knowledge Capital in the field under their supervision and the realisation of its potential. They have to preserve and develop the knowledge of their department, while being controlled and guided by the CKO. This has to be formalised in their position memo.
- ***Defining the objectives***
  Managers have to develop expectations for the organisation and the interested parties in order to develop a strategic vision of knowledge and focus on the central issue of knowledge: develop a knowledge sharing culture that contributes to the efficiency of knowledge-based activities, and is one of the leverages of creativity.
- ***Responsibility and authority for the knowledge management***
  The responsibility of the knowledge management has to be recognised (empowered) to ensure that it is formalised, implemented, assessed and continually improved. The adequate structure has to be defined for the best efficiency of the Knowledge Management system (Chief Knowledge Officer, Knowledge Manager, etc.). Ultimately, KM should become everyone's concern. It is therefore the responsibility of the Management to ensure that all parties understand the KM and feel accountable for its success.

▸ Resource management

There are three types of resources:

- Resources dedicated to specific KM projects for specific KM transverse projects (e.g. deployment of KM methods, pilot projects),
- Resources allocated directly to specific departments or teams for specific KM projects included in the corporate KM plan,
- Resources for supporting general KM projects (e.g. software developments).

▸ Process management

Knowledge Management is implemented through "Knowledge Management processes" described in the present document. As an integrated system, KM is tightly related to other systems and processes of the organisation: HR processes, Quality processes, IT systems, organisational units, business processes, document management systems... Moreover, links with other external programs as national or international programs have to be specified.

ANNEX: *KM Framework*

3.3 Evaluation of the Knowledge Maturity of a company

Process : P6: Monitor the KM System
Subprocess: P6.1 Define KM policy and goals
Subprocess: P6.2: Assess the KM System performances

Most of organisations have, implicitly or explicitly, Knowledge Management processes running within their departments, and it is not always easy for managers to evaluate the benefits of new processes in that domain. The KMM (Knowledge Management Maturity) is a reference grid that gives a coherent framework, allowing to formulate the good questions, and have a pertinent approach, in order to get a good idea of the company maturity in that domain. The Knowledge Maturity Model is a first approach to evaluate the state of the art within a company in the KM domain, taking in account all the multiple aspects of a KM strategy. It is based on a simple evaluation grid of 18 criteria, which have to be graded on a scale of four levels.

ANNEX: *KM Framework*

3.4 Implementing KM Process :

P6: Monitor the KM System
Subprocess: P6.3: Define and Monitor a KM improvement project

The Knowledge centred approach proposed in this document includes four steps that achieve a virtuous Knowledge Cycle for KM shown in *Figure 3*.

Step 1: Building a KM Plan

Because the knowledge resources of an organisation are its main asset, building on this capital and maximising its potential are key conditions to develop and achieve sustainability. However, the same knowledge resources of an organisation are vulnerable and subject to threats, for example by knowledge loss (mainly an important loss of tacit knowledge). Therefore, it is essential to plan for the preservation, the transfer, the evolution and the creation of knowledge throughout the organisation's activities and its interactions with its audiences. The KM plan must be designed and integrated as a strategic process of the organisation.

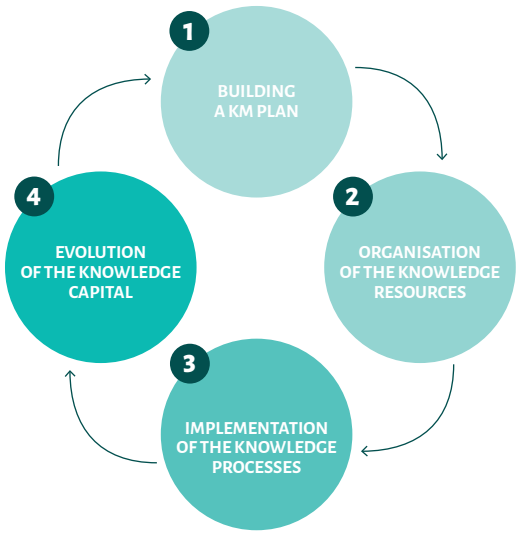

Figure 3: *the Knowledge Management cycle*

Building a KM plan will primarily required addressing the following question:

- What knowledge domains are critical and the most valuable for the organisation?
- Are they strategic?
- Which are the main threats and risks incurred by those domains?
- Who holds this knowledge?
- What are the possible and relevant operational actions to manage that knowledge?
- How to ensure the alignment of the mid-term action plan with the strategic objectives of the organisation?

To answer these questions, it is necessary to have an audit of the Knowledge resources, guided by the strategy defining the missions of the organisation. Proposing an action plan for preservation comes next: sharing and evolution of knowledge that is aligned with this strategy. Its first step requires a strategic analysis of the Knowledge resources, whose objective is to identify the critical knowledge domains in the organisation and the adequate actions to reduce their criticality. The KM plan built in this way identifies which knowledge management processes are required for which knowledge domains.

Step 2: Organisation of the Knowledge Resources

For the critical knowledge domains identified in the first step, a wide range of knowledge resources can be identified; hence the need to put them in order and establish how they are organised.: A first type of resources is codified, as databases, information and document resources, software resources, web

resources ... A second type of resources is not codified as tacit knowledge of experts and specialists, knowledge communities (e.g. communities of practice), networks...

Usually that huge knowledge corpus is scattered in various sites, tacit knowledge is not sufficiently elicited, links between knowledge chunks are often missing... There is no comprehensive view of the knowledge corpus (tacit or explicit) associated to each knowledge domain, and knowledge is far from being easily accessible. It is a difficult task to map the resources, to design a coherent repository to facilitate their organisation, allow their maintenance and ensure their availability. This implies often adding new knowledge resources and artefacts to that repository.

Step 3: Implementation of the Knowledge Management processes:

The next step is to organise the utilisation of the knowledge resources in the daily work of the knowledge workers: how can they share, transfer, acquire, etc. their knowledge in order to be efficient in their operational or decision tasks? As Business Processes are implemented to support operational activities, Knowledge Management processes have to be implemented to support knowledge utilisation in these Business Processes, as required in the KM plan.

Step 4: Evolution of the Knowledge resources

The final goal of KM in any organisation is to be a creative organisation. Similarly, we consider that it is the ultimate goal of the KM processes to nurture innovation. Therefore, the KM process shall result in the capability of the organisation to make the set of its Knowledge resources evolve in a strategic way by creating new knowledge. Then, the KM process must use all the resources created in the previous steps to foster corporate knowledge evolution. Finally, as the business and the processes are continuously evolving, it is a requirement to ensure KM keep focusing its effort on the right resources and stay relevant. A good way to achieve this is to put some mechanism in place (e.g. survey or tracking) to measure how the knowledge is consumed and how it benefits to the organisation.

3.5 *Supervising the KM system Process :*

P6: Monitor the KM System

Subprocess : P6.4: Monitor the KM Processes (Decision process, Management process, ...)

The *P6.4* process aims at maintaining the KM System in a sustainable way. That means monitoring it and managing change requests according to the company needs. The key elements are a KM Roadmap broken down into KM phases and action plan. The KM Roadmap describes the necessary resources allocation, the decision process, the Reviews to carry out (type of Reviews, Field of Review, and Date of Review) and the reporting plan. P6.2 gives different kind of usable Reviews and Indicators. However, Reviews and indicators to apply depending of the context are given by the KM Management plan, which is made on an annual basis.

The KM phases and action plan describe the necessary improvements to do in the KM System with the number of phases per year. It could be about KM training courses, extending best practices, developing new tools or improving existing tools, new knowledge to capture with knowledge owner appointment... This KM roadmap is carried out in an annual KM System Decision Review (described in the decision process). Then P6.3 (Define and Monitor a KM improvement project) is used to carry out improvements. Usually these plans are built on an annual basis and the KM System is managed according to them.

Part 4
Needs analysis: building a KM plan

Process: P4: Manage the company's Knowledge Base
Subprocess: P4.1: Insure the relevancy of the capitalised knowledge
Subprocess: P4.2: Select the knowledge in accordance with company's environment evolution.

Once the KM framework has been defined, building a KM plan will require completing different tasks:

- **Task 1:**
  Build the Operational Objectives Map
- **Task 2:**
  Build the Knowledge Domains Map
- **Task 3:**
  Critical knowledge assessment
- **Task 4:**
  Alignment and decision for the KM plan

The organisation of the tasks is described in *Figure 4*.

4.1
Build the Operational Objectives Map

The Operational Objectives Map is a simplified graphical representation of the operational objectives of the company.

The Operational Objectives Map has to be set by managers, according to the mission of the organisation, by choosing the main functions that must be realised, and identifying the tasks necessary to perform those functions. This may be done through a collective analysis by the managers and others involved. It recognizes the core areas where KM is a critical factor to enhance operational effectiveness and achieve business resilience.

ANNEX: *Operational Objectives Map*

4.2
Build the Knowledge Domains Map

The Knowledge Domains map (or Knowledge map) is a representation, given by the knowledge actors, of how the knowledge domains are structured. The knowledge domains contain the know-how or skills (also known as KSA: Knowledge, Skills and Attitudes) which are useful and necessary to operate the different business processes. This map is split into knowledge axes (or themes), domains and then sub-domains. This map aims at representing t the different knowledge domains in the

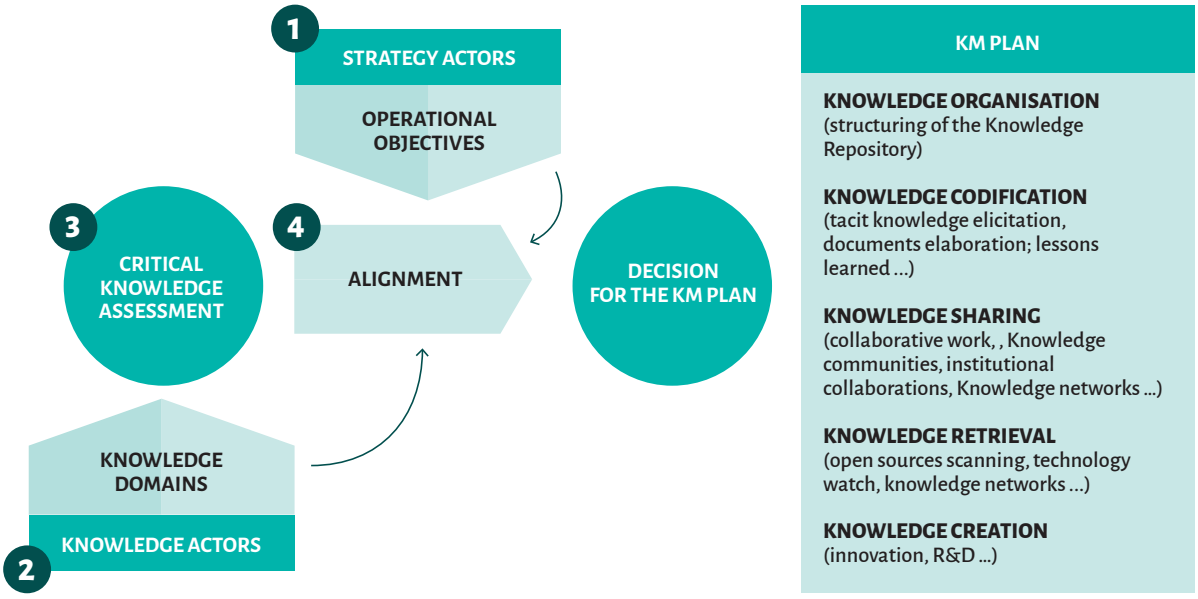

Figure 4: *How to build a KM plan*

organisation in a clear and easily understandable way. This map must be consensual among the knowledge actors; it represents a shared view of what is the knowledge necessary and sufficient to achieve the operational objectives.

ANNEX: *Knowledge Domains map*

4.3
Critical knowledge assessment

Once we have a agreement on the Operational objectives *(task 1.)* and a clear picture of the different domains that form our KM dynamics *(task 2.)*, we need to establish our priorities and determine where our organisation would benefits the most from a structured KM plan. This is what we refer as the Critical Knowledge assessment.

What is a critical knowledge is not trivial. The first obvious criterion for criticality is the risk of knowledge loss, but it must be balanced with others criteria (a non-strategic knowledge is not very critical, even if there is a strong risk of knowledge loss). Critical factors are about vulnerability, gaps, strategic issues, acquisition, complexity etc. It is important to identify the knowledge assets that are strategically important for the organisation to fulfil its mission and achieve its potential, and the knowledge assets to preserve and/or augment. It is suggested to carefully define and discuss a comprehensive grid of Critical Knowledge Factors (CKF).These tools will be used as support for the interviews during the evaluation of the criticality of the knowledge domains. For each knowledge domain, one has to designate reference people that will be interviewed for the assessment of the domain criticality. This step (called «name dropping») may be difficult, especially in large organisations. The credibility of the assessment is based on the legitimacy of the people solicited. A knowledge map can be very detailed, but one has to choose a level of granularity in the map that does not require too many interviews.

Criticality assessment systematically uses the criticality grid built with the set of Critical Knowledge Factors and a rating procedure. Evaluation of the criticality of one knowledge domain consists in rating every criterion for that domain. The higher the rate is, the more critical the domain is. Each domain is evaluated independently from the others. The method may lead to heavy implementation, regarding the number of domains and criteria used and if there are many evaluators. That is why it is suggested to use tools to facilitate the evaluation task. Results are graphically synthesised in a «radar» (also called Kiviat) diagram and other Excel representations.

Thematic axes	*Criteria*
Scarcity	▸ *Number and availability of holders* ▸ *Specific (non-subsidiary) character* ▸ *Leadership* ▸ *Originality* ▸ *Confidentiality*
Utility	▸ *Number and availability of holders* ▸ *Specific (non-subsidiary) character* ▸ *Leadership* ▸ *Originality* ▸ *Confidentiality* ▸ *Appropriateness to business operations* ▸ *Creation of value for parties involved* ▸ *Emergence* ▸ *Adaptability* ▸ *Re-usability*
Difficulty in acquiring knowledge	▸ *Difficulty in identifying sources* ▸ *Mobilisation of networks* ▸ *Tacit character of knowledge* ▸ *Importance of tangible sources of knowledge* ▸ *Rapidity of evolution*
Difficulty in exploiting knowledge	▸ *Depth* ▸ *Complexity* ▸ *Difficulty of appropriation* ▸ *Knowledge background* ▸ *Environmental dependency* ▸ *Internal relational networks* ▸ *External relational networks*

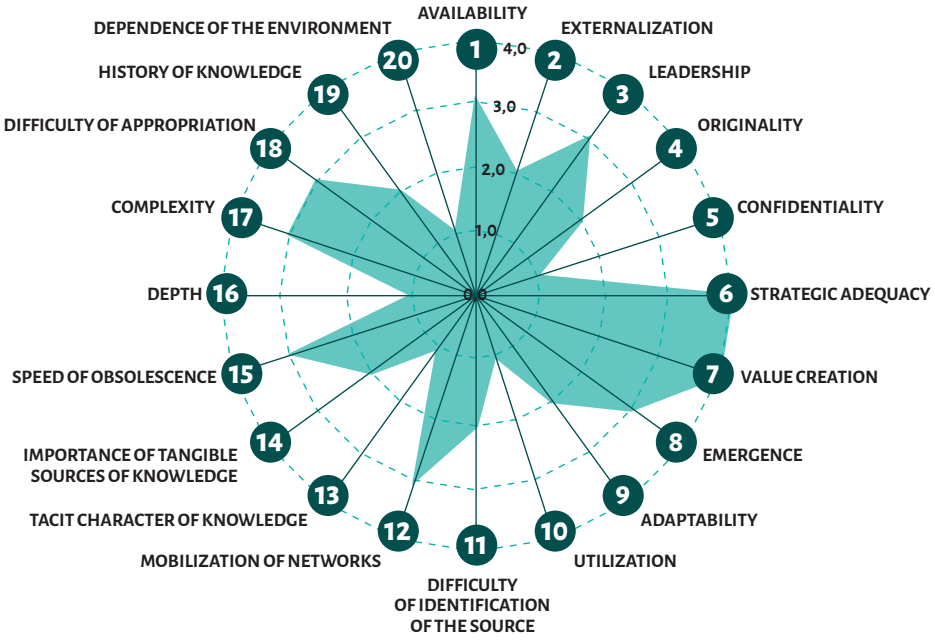

Figure 5: *Grid of critical knowledge factors and a Kiviat diagram obtained with this grid*

Figure 5 gives an example of a Critical Knowledge Factors grid, and an example of Kiviat diagram obtained after an evaluation of a knowledge domain using this grid.

At the end, each knowledge domain is associated to a score that represents its criticality. In addition, We shall then provide each domain with one or two pages describing the highlights that have been pointed out during the assessment (recurring elements highlighted during the interviews and those characterising the criticality of the domain), and the recommendations that have been suggested to face the criticality of the domain (knowledge to capture, to codify, to share, to create ...).

ANNEX: *Critical Knowledge Assessment*

4.4 Alignment and decision for the KM plan

As we have already referred in 2.3 "The Knowledge Pyramid", alignment consists of identifying which knowledge domain is required for which operational objective.

The critical knowledge assessment in stage 3 must be weighted according to this alignment, taking in account how much each domain influences the organisation operations and their functions. The criticality of a domain increases with the number of operational objectives that concern this domain.

The Knowledge Management plan results from the large amount of information collected during the interviews with stakeholders in criticality assessment. This information is summarised in a decision support document including, for each knowledge domain:

- The criticality score obtained by the criticality assessment
- The weighting obtained by the alignment with operational objectives
- The highlights giving the justification of the domain criticality
- The mitigations to reduce the criticality and/or allow a greater alignment

The recommendations maybe of different types: recommendation for managers, recommendation for competence management (training, recruiting ...) etc. The KM plan only selects the recommendation linked to knowledge resources or Knowledge Management processes.

Managers will discuss the decision support document and select the different Knowledge Management processes to be implemented in the different knowledge domains, and the final KM plan must be defined and endorsed by the top management.

ANNEX: *Template for KM Plan design*

Part 5
Implementing the KM plan

5.1
Knowledge organisation

Process: P4: Manage the company's Knowledge Base
Subprocess: P4.3: Manage the content of the company's Knowledge Base

Tangible resources (explicit knowledge)

There are two kinds of tangible knowledge resources:

- Knowledge resources produced by "Knowledge Management processes" as the knowledge formalised in guides and doctrines, lessons learned, learning modules, R&D products, external knowledge resources etc. in the following called "Technical knowledge"
- Knowledge resources used in "operational processes" for operational objectives. These resources, produced by "business processes" are linked to the data and the information collected in the different sites. We are referring to this type of knowledge as "Operational knowledge", for example, reports, incident reports...

Intangible resources (tacit knowledge)

Both technical and operational knowledge are possessed, applied, shared and transformed by the people in the organisation. Unless these behaviours are captured and formalised into process and guidance, they form an intangible knowledge capital that we refer as tacit knowledge.

That intangible capital lives within knowledge networks of various types: communities, social networks... Those networks are often the "living link" between "operational knowledge" (knowledge as a resource of operational processes) and "technical knowledge" (knowledge as a resource for support processes as research and development, quality, marketing, etc.).

The knowledge repository will become the central place(s)

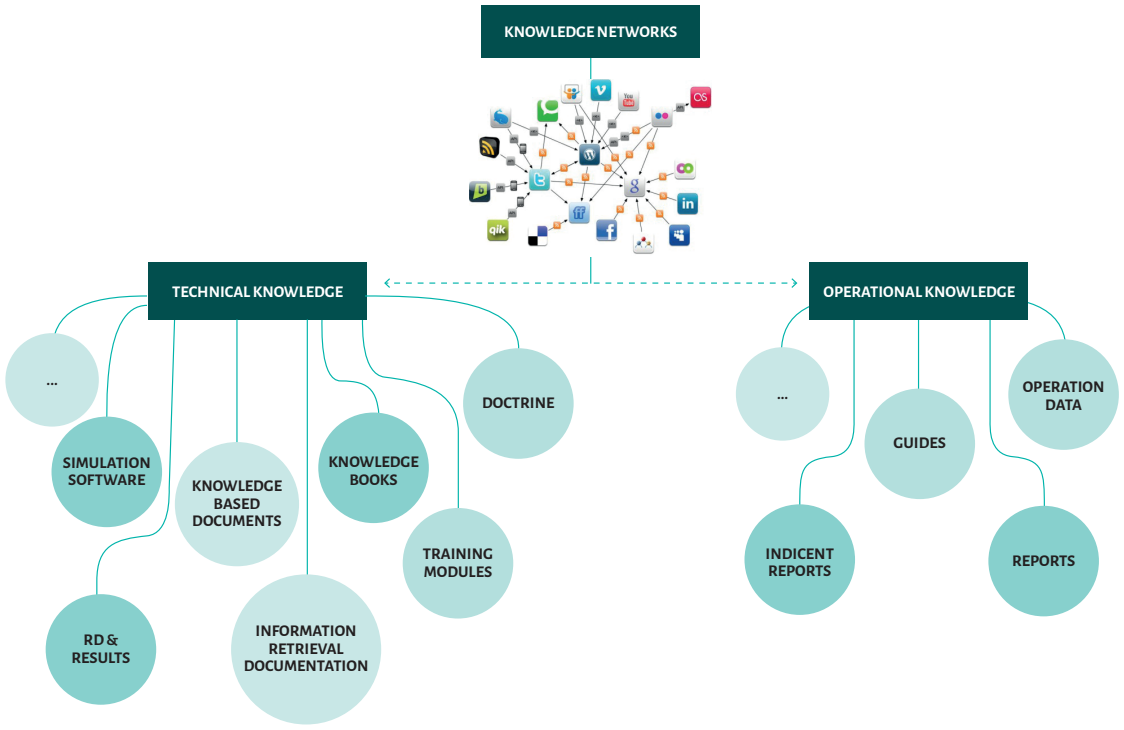

Figure 6: The general architecture of a Knowledge Repository (example)

where the organisation gathers the knowledge resources that support its operational process. We may have different repository, depending on the domain, or a central repository that will consolidate all the information.

Figure 6 gives an example of architecture of a knowledge repository making the distinction between "Technical knowledge" and "Operational knowledge". As shown in *Figure 6*, the knowledge repository is structured in two main modules: the operational knowledge module and the technical knowledge module. Usually, those two modules have common parts, but may have separate management. The operational knowledge is managed by operational departments; the technical knowledge is managed by KM, R&D, documentation etc.

Adding new knowledge resources

The KM action plan usually reveals the lack of knowledge resources, not available in the current knowledge repository. It is then necessary to add those resources, required by the knowledge actors. There are various types of possible knowledge resources. We can also refer to 2.3 "The Knowledge Pyramid" for more detail about the range of resources that the Knowledge Plan should possibly encompass. In the following, some of the most required resources in KM are mentioned.

- ***Yellow pages***
  "Who knows what?" This is a directory where the experts, the specialists are identified, with their knowledge domain and the questions they are able to answer. Building yellow pages with the knowledge actors is a long process, from identifying and validations the experts, to mobilising them for the benefits of everybody.
- ***Web resources***
  This refers to useful and pertinent URLs (internal or external) for knowledge problems. Inventorying and centralising of those different addresses may be difficult and long.
- ***Document classification scheme***
  Access to documentation is never easy, and a big amount of time is dedicated to information search. A good classification system will facilitate access to documentation.
- ***Technical and scientific documentation***
  Especially in complex technical domains, the number of technical and scientific documentations is huge. Identification of the necessary documentation for different purposes, and organisation of its production and access are needed.
- ***Training resources***
  Training modules are a specific and common way to access some knowledge in the organisation. Links may highlight in the knowledge repository useful modules belonging to the learning systems.
- ***Access to knowledge communities***
  Identifying and organising access to the various and numerous knowledge communities (working groups, communities of practice, communities of interest, etc.) is important for socialising knowledge within the organisation
- ...

5.2 *Knowledge codification*

Process : P3: Capitalise the knowledge
Subprocess :P3.1: Formalise and capitalise the operational knowledge (produced in an operational process)
Subprocess :P3.2: Formalise and capitalise the domain knowledge (of a specific domain or from an expert)

Codification processes

- Knowledge based documents (basic principles, doctrines, handbooks, standards...)

Different types of knowledge like rules, principles, doctrines, returns on experience, etc. need often to be codified in documents. These are very important knowledge resource in the scope of KM.

ANNEX: *Elaborating knowledge based documents*

- Knowledge books (tacit expertise elicitation)

A knowledge book is the elicitation of some critical tacit knowledge (individual or collective). It is a special type of document (that may be hypermedia) that requires specific methods, belonging to the set of Knowledge Engineering methods.

ANNEX: *Design of knowledge books*

Lessons learned, return on experience

The PMI (Project Management Institute) defines Lessons learned as the learning gained from the process of performing a task. Lessons learned may be identified and documented at any point during the project's life cycle. The purpose of documenting lessons learned is to share and use knowledge derived from experience to:

- Promote the recurrence of desirable outcomes
- Preclude the recurrence of undesirable outcomes

As a practice, lessons learned includes the processes necessary for identification, documentation, validation, and dissemination of lessons learned. Utilisation and incorporation of those processes includes identification of applicable lessons learned, documentation of lessons learned, archiving lessons learned, distribution to appropriate personnel, identification of actions that will be taken because of the lesson learned, and follow-up to ensure that appropriate actions were taken.

Implementing an effective "lessons learned process" is one of the most popular Knowledge Management process. For any critical task, or any important project it is very useful to implement such a process. This process is an international standard of Project Management; so many guides are available for its implementation.

See:
Lessons learned process description on PMI site (2017)
https://www2a.cdc.gov/cdcup/library/pmg/implementation/ll_description.htm

5.3 *Knowledge sharing*

Process: P2: Share the knowledge and ensure its application
Subprocess: P2.1: Share the knowledge
Subprocess: P2.2 : Ensure the knowledge application

Knowledge communities or communities of practice

In practice, people interact one with the other, hence creating the conditions for this tacit knowledge to circulate and disseminate throughout the organisation. This often results in the creation of specific Knowledge network and communities of people sharing the same knowledge. It therefore becomes essential for the organisation to harness that knowledge in a way or another, hence the importance for KM to organise those knowledge networks and, to a certain extent, support their operations.

In KM, the most popular way for implementing Knowledge Sharing is the use of "communities". There are a lot of type of communities, and a lot of definitions. Here are two main definitions:

- A knowledge community is a group of people within a company who engage in knowledge-sharing activities in support of a common work interest (shared responsibility for a business process, a product or service, or a project…). The knowledge community may include people from multiple disciplines within the company, as well as extended-company participants (service providers, supply-chain partners or customers).
- A Community of Practice is a group of people who share a mutual professional interest for something they do, and who interact regularly to learn how to do it better.

Every network of people with a common interest is not a knowledge community or a community of practice however. We have identified three characteristics which are crucial:

The shared domain: A community is not merely a network of connections between people. It has an identity defined by a shared domain of interest. Membership implies a commitment to the domain and therefore a shared competence that distinguishes members from other people.

The commitment in the community: In pursuing their interest in their domain, members engage in joint activities and discussions, help each other, and share information. They build relationships that enable them to learn from each other.

The shared directory: Members of a community are knowledgeable practitioners. They develop a shared directory of resources: experiences, stories, tools, and ways of addressing recurrent problems. This takes time and sustained interaction

Theme	Criteria
Shared Domain	▸ *Legitimacy* ▸ *Missions* ▸ *Domain of common interest* ▸ *Knowledge creation*
Commitment in the community	▸ Membership ▸ Behaviour Code ▸ Motivation ▸ Level of participation ▸ Mutual trust
Shared directory	▸ History ▸ Common frame of reference ▸ Information Capital ▸ Shared values ▸ Identity
Collaborative work	▸ Communication ▸ Organised activities ▸ Cooperation / Collaboration ▸ Collaborative tools

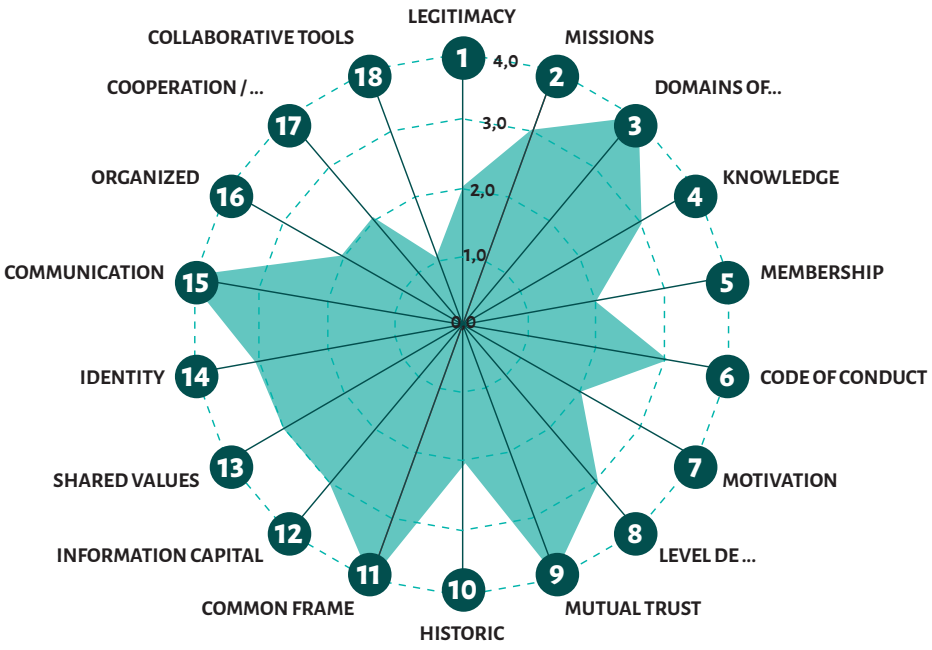

Figure 7: *Grid of key success factors for a knowledge community and a Kiviat diagram obtained with this grid*

A combination of those three characteristics determines how the community is adequate for Knowledge Sharing. Adequate tools are strongly enhancing the community performance.

In addition, comprehensive range of communication and collaborative tool will create the condition for effective knowledge sharing, mutual learning and problem solving across the community, hence achieving its purpose.

Enabling a community for Knowledge Sharing is not straightforward. There are a lot of failure factors. A careful attention to the structure and the functioning of the community is necessary to manage that kind of knowledge network.

The annex gives an Excel tool that can be helpful in that purpose. It is a Community Maturity Model (CoMM) that gives 18 key factors of success for a knowledge community. It provides a way to evaluate an existing community, leading to a Kiviat diagram, characteristic of its Knowledge Sharing capacity *(Figure 7)*.

***ANNEX:** Community Maturity assessment*

Knowledge Transfer:

Knowledge Transfer is the practical problem of transferring knowledge from one part of the organisation to another. It aims at organizing, capturing, creating, or disseminating knowledge and ensuring its availability for future users.

Knowledge Transfer maybe understood in a very large scale, sometimes rather equivalent to Knowledge Management. Here, it will be considered as a process that includes a variety of interactions between individuals and groups to communicate and share knowledge such that the recipient of knowledge has a cognitive understanding, and the ability to apply the knowledge. Sometimes this process is referred as "Knowledge Translation".

Before being implemented, a Knowledge Transfer process has to be clearly defined in terms of:

- Justification of the needs for knowledge transfer
- Knowledge to be transferred
- Expected benefits and KPIs (to measure how effective the uptake from the recipient of the K transfer is)
- Context of the knowledge transfer
- Actors (Knowledge holders, Knowledge recipients ...)

The Knowledge Transfer process can be illustrated by *Figure 8*.

Methods and processes for knowledge transfer are numerous. Here are some widely used:

- **Training**
  - Face to face learning
  - E-learning (autonomous or tutored)
  - Virtual classrooms
  - Serious games or role playing games
- **On job training**
  - Mentoring or tutoring
  - Work-based/School-based learning
- **Knowledge Networks**
  - Working group
  - Community of practices
  - Expert network

Supporting technologies for knowledge transfer are also numerous. Here are some examples:

- Content Management System
- Blogs
- Wikis
- Shareware
- Knowledge portals or knowledge servers
- Collaborative tools
- ...

***ANNEX:** Guide for implementing a knowledge transfer process*

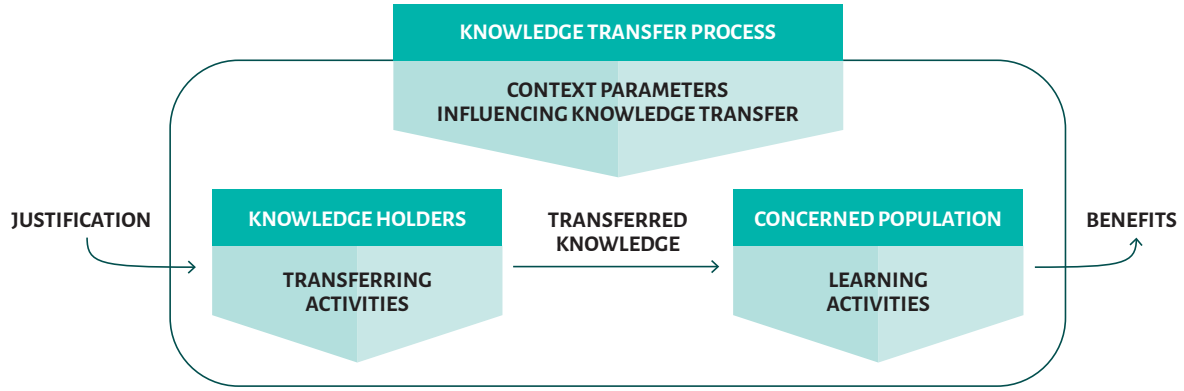

***Figure 8:** The Knowledge Transfer process*

5.4 Knowledge search

Process : P1: *Create and learn*

In KM, knowledge search (also called "knowledge acquisition", but there are many other definitions of that term) refers to the knowledge that an organisation gathers from external (in some cases internal) sources. Sources include suppliers, competitors, partners/alliances, customers, external knowledge networks etc... Knowledge search is supported by information retrieval from a more and more wide range of information resources, and knowledge providers. This knowledge might be freely available, in which case the organization will arrange its own «business intelligence», and sometime dedicate special team to perform the knowledge gathering. It may also tender for external knowledge agency that will provide specific information or service (e.g. press review). Finally, the Knowledge Search can be a one-off exercise or a task performed on an on-going basis. Information retrieval uses database management systems, suitable for retrieval of structured data or web search engines, suitable in finding the relevant documents or web pages. To leverage the increasing data volumes available on the Internet and other information sources, knowledge search processes need not only to retrieve already available information, but also to generate knowledge.

Knowledge search is a systematic process of capturing, analysing and exploiting useful information for knowledge generation in an organisation. Technology watch or Environmental scanning processes are significant and important examples of knowledge search processes.

The task of Technology watch is to observe, track, filter out and assess potential technologies from a very wide field extending beyond the normal confines of the sector. The Technology Watch process must be capable of identifying any scientific or technical knowledge useful for the organisation's innovation process. A Technology Watch process can be broken down into four main phases: a needs audit, data collection, processing of the data collected, integration, and dissemination of the results.

Environmental scanning is the study and interpretation of the political, economic, social, technological environmental and legal factors that influence the organisation (events, trends, issues and expectations of the different interest groups). Results are often forerunners of trend breaks and major changes to come in the organisation's Knowledge resources (e.g. a value shift in society, a technological breakthrough innovation, a paradigm change...). The Environmental scanning process deals with gathering information about events and their relationships within an organisation's internal and external environments and the analysis of this information.

The Knowledge search process is always composed of four main phases: requirement needs analysis, information retrieval, representation of the information collected, and knowledge generation. More precisely, these phases can be performed through six successive tasks:

1) Projection

The question is "what is the request?" Before sending a request to the available information corpus ("projection"), it is necessary to have a clear view of what information is needed, what is the objective, and are what the pertinent information resources to investigate.

The corresponding task is the mapping of (tacit or explicit) knowledge representation of a part of the Knowledge resources of the organisation with the perceived or perceivable environment.

It is a knowledge-based task. So it is suggested to analyse and structure the existing knowledge by interviewing the domain experts, to make a state of the art of their knowledge, to reformulate the initial question (which is often ill-based), with new point of views, and to have a better structuring of the domain to be enriched by the knowledge search process. Axes for information retrieval are decided, and a first phase of information retrieval is performed.

2) Information retrieval

- ***Identification of weak signals***

After the first phase of information retrieval performed with the projection task, a trouble is caused by the perception by the knowledge actors of the organisation of a discrepancy between the image of the projection and the environment. Differences appear because the knowledge in the organisation has not a one-to-one correspondence with the information in the observed environment. This task leads to the discovery of what is called "weak signals", or "singularities". It has to be organised with discussions with the domain experts, brain storming etc.

- ***Analysis of weak signals***

This task makes explicit the weak signals, the points of interests that have been discovered, and refines the required information retrieval.

- ***Relevant feed-back***

It is a graduate task to eliminate in the searched corpus what is non-pertinent and to focus on what is important for the initial objective. The issue of that task is the best possible information corpus relevant to the initial problem of knowledge search.

3) Representation of the information collected

The obtained corpus in the previous tasks is always voluminous. It is a long list of data, documents, web pages etc. It is unable to give a clear view of the content and the signification of what has been obtained. Then a thorough analysis of this corpus is necessary to communicate the results to the actors, in an understandable language. Mathematics and/or cognitive operations must be performed on the different part of the corpus to build special representations, models, graphs, grids or any other means (mainly based on graphics, figures...) to explain the results of the information retrieval process.

4) Knowledge generation

The last task is the transformation of the information retrieved in the previous tasks into knowledge that is useful for the organisation. This task is often reduced to the dissemination of the results of the information retrieval process to the concerned actors, who are supposed to tacitly transform that information into knowledge. From a KM perspective, it is not sufficient and efforts have to be made to organise a shared understanding of the information retrieval process (socialisation of the results), to integrate explicitly the generated knowledge in the Knowledge resources, to support new decisions etc.

The different tasks may be supported by IT tools. They are numerous and various tools to support the information retrieval process (text mining, text analysis, search engines ...), and organised information sources (Bibliographies, Catalogs, Indexes, Finding Aids, Registers, Online Databases...). There are a lot of information professionals able to support that process in relation with the clients. This is also the case for the representation task (data visualisation, infographics, concepts mapping, mind mapping ...). On the other hand, the first and the last tasks in the process (projection, and knowledge generation) are KM tasks, and for the moment, they lack methodologies and tools.

5.5 *Knowledge creation and innovation*

Process : P1: *Create and learn*

The general definition of Knowledge creation in KM is the formation of new ideas through interactions between explicit and tacit knowledge in individual human minds following the celebrated Nonaka's cycle, combining the four processes of knowledge transfer between tacit and explicit knowledge : socialisation, externalisation, combination, internalisation as seen in *Figure 10*.

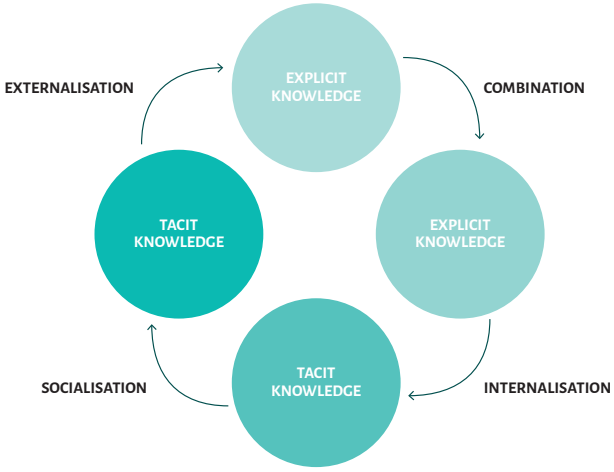

Figure 10: *The Knowledge cycle for knowledge creation*

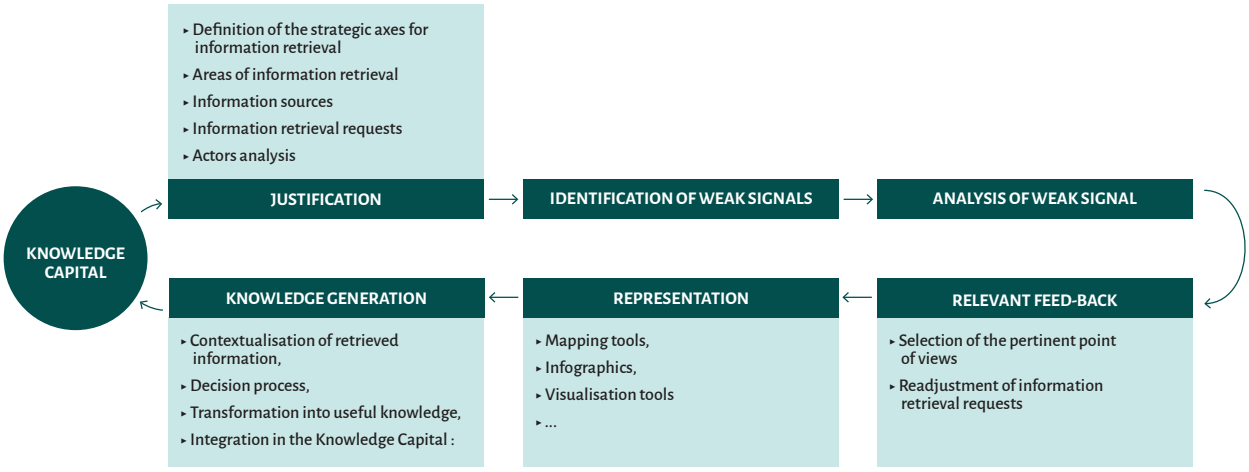

Figure 9: *The Knowledge Search process*

This definition contains in itself the whole framework of Knowledge Management, and one must distinguish between Knowledge Transfer (defined in § 5.3) and Knowledge Creation. Knowledge Sharing and Knowledge Creation go hand in hand, because knowledge is created through practice, collaboration, interaction, and education, as the different knowledge types are shared and converted.

In fact, the ability to create new knowledge is often at the heart of the organisation's competitive advantage. Because it sometimes overlaps with innovation management, some company might decide to handle this issue as a separate function. If one chooses a broader knowledge management definition, one must refer to some aspects that pertain to innovation.

To be consistent, the definition of the process of knowledge creation in KM is the overlapping part of the innovation process that requires KM support.

The literature on innovation process in organisations is huge. It is impossible to make an exhaustive description. However, most models and methodologies propose, partly or entirely, a process in eight phases:

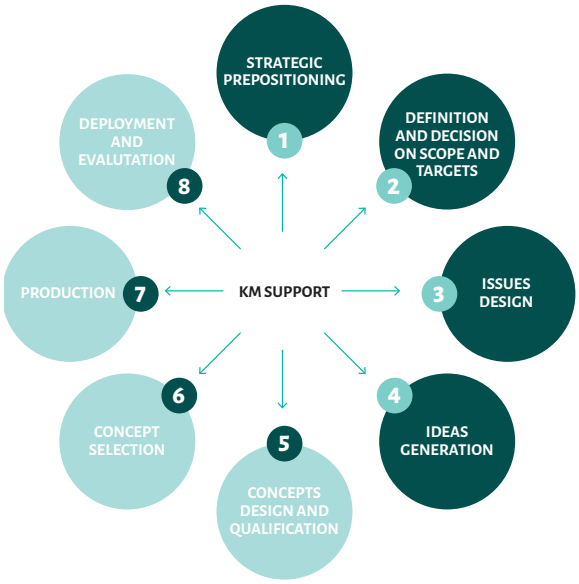

Figure 11: A generic innovation process

1. Strategic prepositioning: choice of innovation as a strategic priority by creating favourable conditions for its deployment: Trends analysis, technical watch, environmental scanning, competitive intelligence...
2. Definition and decision on scope and target: analysis of market needs, definition of targets and priorities, determining the scope and the environment of the problem
3. Issues design: sharing issues between research and marketing, building scenarios, anticipating opportunities and risks, identifying key factors of success
4. Idea generation: implementation of creativity methods and techniques, innovative design approaches, disruptive research...
5. Concepts design and qualification: transforming ideas into concepts, assessment in terms of added value, cost, quality and deadlines
6. Concept selection: project selection, feasibility study, definition of output products, their ecosystem and the production process
7. Realisation: design, implementation and test projects, prototyping, industrialisation, production organisation
8. Deployment and evaluation: protection of the innovation, diffusion, evaluation of its introduction in the market

Only the processes 1, 2, 3, 4 and 5 are related to KM processes. For instance, process 1 needs the support of a knowledge search process, as it has been already discussed in the former paragraph.

Processes 4 and 5 deal with creativity and inventiveness, which are two parallel activities: "ideas generation" from one hand, and "concept design and qualification" on the other hand. Creativity is considered as ideas generation and inventiveness corresponds to knowledge creation from these ideas (design knowledge). There is often no distinction between creativity and inventiveness. Creativity techniques are often uncorrelated both to existing knowledge and to the creation of new knowledge, materialised as new Knowledge resources (by patents or documents, for instance).

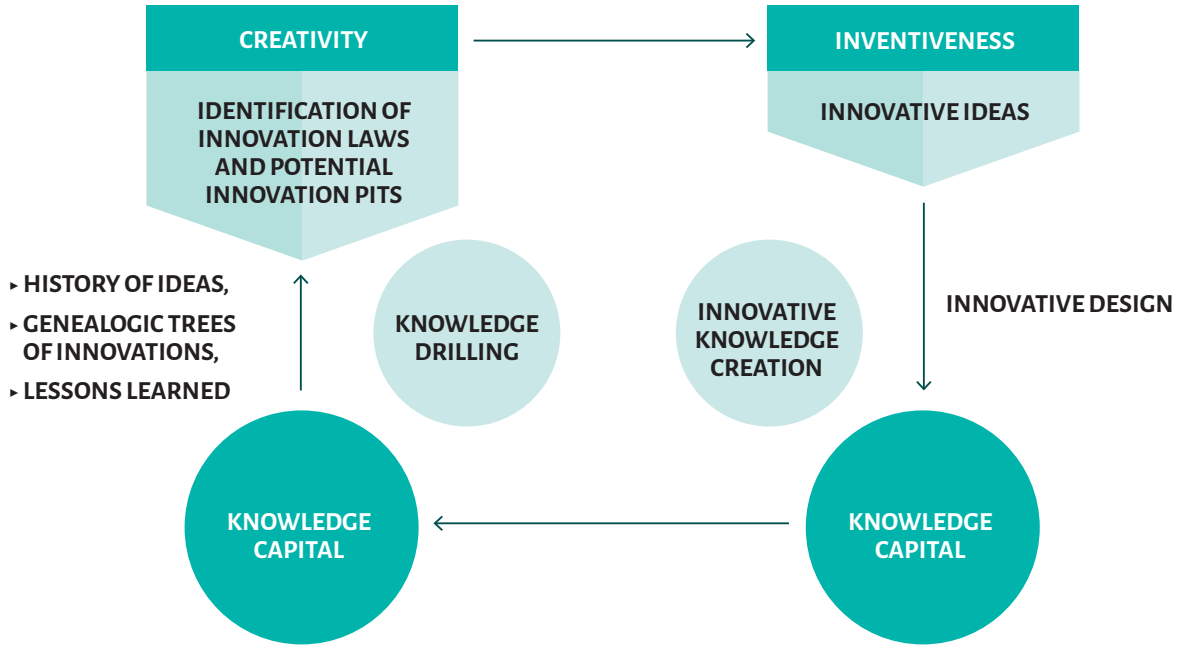

Figure 12: *Knowledge Based Innovation process*

The correlation with creativity and the knowledge resources of the organisation is called "Knowledge Based Innovation" (KBI). Knowledge Based Innovation follows the process illustrated in *Figure 12*.

The Knowledge Based Innovation process has two main phases:

▸ Knowledge drilling as a support of creativity.

Creativity is an evolutionary process of the knowledge resources of the organisation. The evolution of ideas follows the guidelines set by past developments, according to knowledge trajectories that can be tracked by analysing the knowledge resources: choices, decisions, discoveries, lessons learned etc. that have been produced in the past. Knowledge drilling is a careful analysis of the history of past ideas and innovations that have led to significant changes in the organisation or that have been discarded for some reason. The analysis of this history is then extrapolated to identify some potential useful ideas for future innovation.

There exist many creativity methods, but a few are based on knowledge drilling.

The most popular creativity tools, with numerous classical methods are the brain-storming methodologies. They include a phase of divergent thinking (getting away from the given problem, calling for subjectivity, analogy, imagination in order to come back later to the problem from another angle) and a phase of convergent thinking (transforming ideas into solutions answering the initial problem, using a logical reasoning).

An example of knowledge-based knowledge creation method for problem solving is the famous TRIZ method, Russian acronym standing for Theory of resolution of Inventive Problems, elaborated by G.S. Altshuller in the 80's, is dedicated to the resolution of technical problems needing innovative solutions. It shows that, when facing such kind of problem, it is possible to find inspiration in another fields to solve similar problems. TRIZ is the archetype of knowledge-based innovating design method: it looks after existing ideas in databases and the so-generated solutions are all based on existing knowledge. It is typically a creativity method, as long as it provides no mean to concretise the chosen solution and it needs extra process to provide innovative design and knowledge able to be patented as an invention.

▸ Innovative knowledge creation as a support of inventiveness.

Inventiveness is a transformation process of the creative ideas into effective knowledge in order to design new products, new services, further improvements etc. It implies often a Research and Development activity. This process is a key process for Knowledge Management, because its issue is the elicitation (by documents, studies, patents ...) of an effective knowledge that must be capitalised as a new knowledge resource.

ANNEX: *A Knowledge Based Innovation process*
ANNEX: *Innovation Maturity assessment*

Contributors

This document is an introduction to the KM repository of the French Knowledge Management Club (Club Gestion des Connaissances) founded in 1999. This repository includes case studies in member organisations, practical tools designed in the working groups (referred as Annexes in this document), and training material dedicated to these tools, lessons learned etc.

We would like to thank all the contributors who helped to build this KM repository of the French Knowledge Management Club during those last twenty years.

We compiled the list of participants from the reports of all the working groups that contributed to the ideas, concepts and tools that are presented in this document. The companies cited are those where people were when they participated in the work. They may have changed or disappeared. We apologize for any errors or omissions.

ADAM RAOUL (CEGOS)
ALVAREZ THOMAS (CLIENTLOGIC)
ARIÈS SERGE (CONSULTANT)
ARTAUD CLAUDE (VOLVO POWERTRAIN)
AUBERTIN GÉRARD (INSTITUT NATIONAL DE RECHERCHE ET DE SÉCURITÉ)
BARRON MURIEL (DYNAXIS)
BARTOLI JACQUES (IAE AIX EN PROVENCE)
BEAUCHESNE LAURENT (MARINE NATIONALE)
BELOUX OLIVIA (PSA PEUGEOT CITROËN)
BENMAHAMED DJILALI (SONATRACH, ALGÉRIE)
BENHAMOU PHILIPPE (OFFICE NATIONAL D'ÉTUDES ET DE RECHERCHES AÉROSPATIALES)
BERETTI ANNIE (PSA PEUGEOT CITROËN)
BERGER ALAIN (ARDANS)
BÉZARD JEAN-MARIE (PLÉNITUDES)
BIALÈS ALICE (SERVICE PUBLIC FÉDÉRAL BELGE)
BLATTER CHRISTIAN (SNCF)
BONNET JEAN LUC (DIALOGIE)
BOUGHZALA IMED (INSTITUT NATIONAL DES TÉLÉCOMMUNICATIONS)
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