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PROGRAMME

Thematic Network / Roadmap

D 5.2. Knowledge Management Maturity Model

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1 Introduction

The VISION project aims at the development of a Science and Technology Roadmap for the next-generation Knowledge Management (KM). Important new technology developments that contribute to the realisation of a more competitive and qualitative Knowledge Society of the future will find its place in this roadmap indicating what research, technology developments and validation will be required. Such a roadmap may include technologies that may range from new semantic web technologies, groupware systems to mobile technologies but may also include research activities related to organisational, human and business necessary to realise a well functioning Knowledge Management system and process within organisations.

European research (e.g. SENEKA) indicate three axes for research on KM, Technology, Organisation and Human Aspects; the so called HOT triangle. Each of these issues play an important role in realising successful KM. Whereas a wide range of technologies come available and need to be integrated towards functional KM systems, VISION focuses on designing **Knowledge Management for people** instead of making people adapt to KM.

Such an approach takes into account the Critical Success Factors for KM implementation as it results from a survey carried out by Fraunhofer IPK, (Heisig, Vorbeck 2001) amongst 104 companies. The following figure indicates these critical success factors and their relative importance as perceived by CEO's.

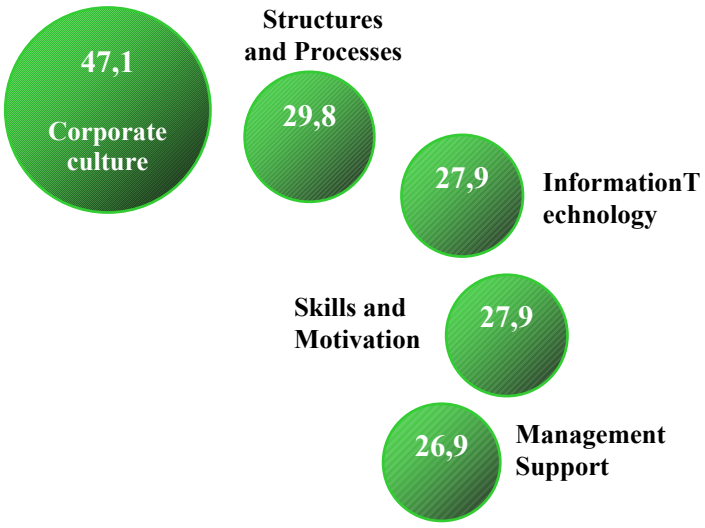

Figure 1-1 KM CSFs

Such an approach and the ambition to actually contribute to the **accelerated take-up** of KM in Europe necessitate various initiatives that range from research to applied research and take-up actions within user contexts.

In order to actually contribute to these goals the VISION roadmaps have to take into account KM-Critical Success Factors (KM-CSF's). VISION therefore provides a model:

1. To study the user context and readiness (user group maturity levels) of targeted user communities in the context of future research activities;
2. To map the maturity levels of KM-Technologies and required initiatives to progress towards state of the future (RTD oriented maturity levels);
3. To identify the type of projects to be promoted through the roadmap taking into account both technology maturity and user groups' maturity levels (an implementation process model) .

Due to the human orientation of KM, research and development activities have to take account of user orientations leading to iterative research methodologies in which direct feedback from users needs to focus and validate research activities and results. VISION advises to use the new instruments of Integrated Projects in the Sixth Framework Programme to carry-out detailed user oriented research and assessments needed to establish the level of readiness to take-up innovative KM solutions as a basis for the development and validation of next generation KM-Technologies and applications.

The level of readiness to take-up innovative KM solutions determines the maturity of (advanced) user communities and their possibilities to actually experiment with and take-up innovative KM solutions, including novel organisational and human resource management practices.

2 State of the Art on Maturity Models

In order to be able to decide on the relevant type of R&D related projects to actually realise the next generation Knowledge Society within the upcoming 5-10 years the VISION project develops a Knowledge Management Maturity Model ("VISION KMMM").

Essentially, maturity models describe the development of an entity over time. This entity can be anything of interest: a human being, an organisational function, a technology etc. Maturity models have the following properties:

- The development of a single entity is simplified and described with a limited number of maturity levels (usually four to six).
- Levels are characterised by certain requirements which the entity has to achieve on that level.
- Levels are sequentially ordered, from an initial level up to an ending level (the latter is the level of perfection).
- During development the entity is progressing forwards from one level to the next one. No levels can be left out.

Maturity models are a certain result of the application of the life-cycle approach. Each entity develops through the levels over time until it reaches perfection – up to the highest level.

A well-known example of maturity modelling is the Maslow hierarchy. Maslow suggests that there is hierarchy of human needs starting from physiological needs up to self-actualisation needs (Maslow 1943). During progress through the hierarchy of needs all levels must be achieved. In this case the entity is the human individual who progresses through "the pyramid of needs".

In the "VISION KMMM" the it is presumed that a certain level of Knowledge Management Maturity has to be available in user organisations in order to be able to involve these users into the research and development process of the next generation Knowledge Management. The "VISION KMMM" is therefore not developed to guide users to a higher level of Maturity developing from the lower level to the higher level where "no level can be left out". The model has been developed to be able to take into account the Maturity level of User groups in the design and implementation of research programmes and projects oriented at people driven KM.

The "VISION KMMM" therefore combines 2 dimensions on maturity into a single model:

1. RTD oriented Maturity Model
2. Organisation oriented Maturity Models

2.1 An RTD oriented Maturity Model

VISION builds on the maturity model for technology development as applied in the IST programme within the Fifth Framework Programme . Depending on the maturity level of technology different types of projects will be required to advance towards the next step of innovation.

Maturity levels in the Fifth Framework programme to identify the different requirements for R&D related projects and to be adapted as an integrated part of the "VISION KMMM" can be defined as follows (from less to more mature):

1. **Maturity level n+4:**
   A Knowledge Management Technology (KMT) is only available in conceptual form and needs fundamental research and development to be transferred into actual methodologies and technologies. An example of such a conceptual KM idea is ontology learning through knowledge discovery.

2. **Maturity level n+3:**
   A KMT is in its early stages and new knowledge is needed for a specific KMT to be fully developed (RTD). An example of such a technology is extraction of metadata using human language technologies.

3. **Maturity level n+2:**

The KMT is available in prototype or mature version but is not sufficiently mature or customised (ncl. Integration with other T's) for the targeted application and requires experimentation in user contexts (e.g. trial projects) in order to adapt the technology to sufficient maturity level. An example of such a technology is ontological search engine to search information annotated using RDF.

4. **Maturity level n+1:**
   KMT available in proven version but added value for business (stand alone or integrated) is not sufficiently proven for users to buy into it. The KMT is mature for targeted application but needs promotion to accelerate take-up (Best Practices). An example of such a technology is knowledge push technology with automatic generation of user profiles, e.g. based on textual analysis of documents previously requested by the user.

5. **Maturity level n:**
   KM Technology is available in proven version and added value in stand alone or integrated version has been proven by several other users (late majority) . An example of such a technology is conventional search engine technology using text strings.

The following figure outlines the RTD oriented maturity model.

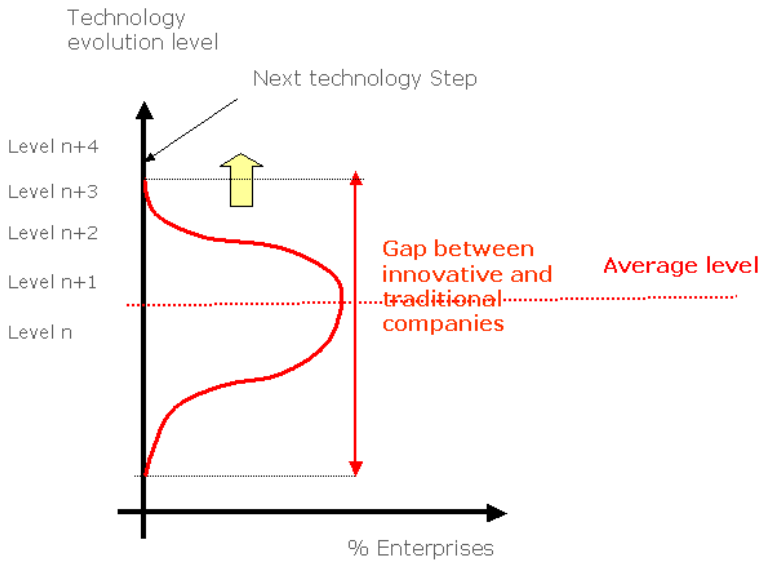

Figure 2-1 RTD oriented Maturity Model

The vertical axis indicates the maturity (or evolution) level of involved technologies whereas the horizontal axis indicates the percentage of enterprises that operate on the various technology maturity levels, indicating the maturity level of a specific user community.

2.2 Organisation oriented Maturity Models

Due to the human and organisational dimensions in KM a KM Maturity Model for the research and development roadmap cannot be limited to the RTD oriented maturity model. The second dimension of maturity that will be relevant to implement R&D roadmaps is the readiness of user communities to take-up innovative KM solutions and the related next step in innovation for the most advanced users. The current level of maturity and requirements for improved KM solutions for the most advanced within user communities strongly determine the type of initiatives to be supported towards the next generation KM.

One approach to considering the maturity level of a community has been adopted by Rolls Royce in the U.K.[1] This is based on asking a number of key questions of the users, e.g.:

- What plans are in place to deal with the loss of key experts?
- What initiates identification of lessons learned?
- Is there recognition for knowledge sharing?

Related to this, one looks for the existence of infrastructure, e.g.:

- intranet
- lessons learned log
- lessons learned review
- (electronic) communities of practice
- people pages

This can be made quantitative, e.g. by looking at the percentage of employees who form part of communities of practice. At the same time the number of alternative implementations of the same functionality should be investigated. In the mature community, there will in general be one implementation of each generic requirement, thus aiding interoperability and reducing cost. An exception to this might arise for reasons of security, e.g. when a part of the company needs to be 'fire-walled' to deal with military security projects.

The test of real maturity is when communities do things off their own initiative, without waiting to be prompted by some central 'knowledge management' team. This requires a high maturity level of the organisations involved in the user communities. In order to measure Maturity Levels various Organisation oriented Maturity Models are available.

State of the art analyses show various ongoing activities as well as existing models that are used to define, assess and evaluate organisation oriented maturity levels. Before we outline the identified maturity models we first wish to give a definition of a

[1] Much of the content of section 2.3.1 is derived from a private communication with Colin Cadas, KM manager Rolls Royce

maturity model as provided by Gallagher and Hazlett in their study on applying a Knowledge Management Maturity Model[2]:

"A Maturity Model defines stages of growth, or maturity, that a firm can be expected to pass through in its attempts to improve its processes and ultimately business performance"

Six existing Maturity Models have been identified:

1. SEI's **"Capability Maturity Model**" for software development published by Software Engineering Institute of Carnegie-Mellon University (Paulk et. al 1993). Microsoft's "IT Advisor for Knowledge Management" (ITAKM) (Microsoft, 1999).
2. KPMG's "**Knowledge Management Framework Assessment Excercise"** (KPMG 1999): KPMG's characterisation of the "Knowledge Journey" (KJ) (Parlby, 1999).
3. Crosby's **"Quality Management Maturity Grid"** (Crosby, 1978) for Quality Management.
4. Siemens' **Knowledge Management Maturity Model** (KMMM®).
5. Hazlett and Gallaghers' **Knowledge Formula** (Kf), (G&H, "The Knowledge Management Formula" 1999).
6. The **KMM Model**[3] from Infosys Technologies

2.2.1 The Capability Maturity Model

The Capability Maturity Model for Software[4] describes the principles and practices underlying software process maturity and is intended to help software organizations improve the maturity of their software processes in terms of an evolutionary path from ad hoc, chaotic processes to mature, disciplined software processes. The CMM is organized into five maturity levels:

1) **Initial**. The software process is characterized as ad hoc, and occasionally even chaotic. Few processes are defined, and success depends on individual effort and heroics.
2) **Repeatable**. Basic project management processes are established to track cost, schedule, and functionality. The necessary process discipline is in place to repeat earlier successes on projects with similar applications.

[2] "Using The Knowledge Management Maturity Model (Km3) As An Evaluation Tool", Draft Paper, Dr. Seamus Gallagher and Shirley-Ann Hazlett, Division of Management & Information Systems, School of Management & Economics, The Queen's University of Belfast.

[3] (V P Kochikar: The Knowledge Management Maturity Model - A Staged Framework for Leveraging Knowledge**,** presented and published at the KM World 2000 conference -- September 2000)

[4] Carnegie Mellon University, Software Engineering Institute (Principal Contributors and Editors: Mark C. Paulk, Charles V. Weber, Bill Curtis, and Mary Beth Chrissis), *The Capability Maturity Model: Guidelines for Improving the Software Process*, Addison-Wesley Publishing Company, Reading, MA, 1995.

3) **Defined**. The software process for both management and engineering activities is documented, standardized, and integrated into a standard software process for the organization. All projects use an approved, tailored version of the organization's standard software process for developing and maintaining software.
4) **Managed**. Detailed measures of the software process and product quality are collected. Both the software process and products are quantitatively understood and controlled.
5) **Optimizing**. Continuous process improvement is enabled by quantitative feedback from the process and from piloting innovative ideas and technologies.

Predictability, effectiveness, and control of an organization's software processes are believed to improve as the organization moves up these five levels. While not rigorous, the empirical evidence to date supports this belief.

Except for **Level 1**, each maturity level is decomposed into several key process areas that indicate the areas an organization should focus on to improve its software process.

The key process areas at **Level 2** focus on the software project's concerns related to establishing **basic project management controls**. They are Requirements Management, Software Project Planning, Software Project Tracking and Oversight, Software Subcontract Management, Software Quality Assurance, and Software Configuration Management.

The key process areas at **Level 3** address **both project and organizational issues**, as the organization establishes an infrastructure that institutionalizes effective software engineering and management processes across all projects. They are Organization Process Focus, Organization Process Definition, Training Program, Integrated Software Management, Software Product Engineering, Intergroup Coordination, and Peer Reviews.

The key process areas at **Level 4** focus on establishing a **quantitative understanding** of both the software process and the software work products being built. They are Quantitative Process Management and Software Quality Management.

The key process areas at **Level 5** cover the issues that both the organization and the projects must address to implement **continual, measurable software process improvement**. They are Defect Prevention, Technology Change Management, and Process Change Management.

Each key process area is described in terms of the key practices that contribute to satisfying its goals. The key practices describe the infrastructure and activities that contribute most to the effective implementation and institutionalization of the key process area.

2.2.2 The Knowledge Management Framework Assessment Exercise

KPMG Consulting UK did a research in 1998 and repeated it in 2000. In 1998 KPMG was interested in the extent to which organisations were aware of knowledge management, took it seriously and were pursuing initiatives to implement it. In 2000 the scope of the research was extended to investigate further organisations claiming that they are implementing knowledge management effectively.

KPMG defined four key areas of knowledge management as **people**, **process**, **content** and **technology**. In each area there are certain activities to be done, all together. Firms can be assessed according to how they implement these activities. The model was used for benchmarking purposes.

On the basis of the assessed activities the firm is placed on a five-level model called **"Knowledge Journey"**. The model starts form "knowledge chaotic" level and it progresses to "knowledge centric". An organisation is "knowledge chaotic" in the sense that it does not demonstrate a relationship between the importance of knowledge management and the achievement of organisational goals, whereas it is "knowledge centric" when knowledge management procedures are an integral part of organisation and individual processes and the value of knowledge is reported to stakeholders.

Placement is defined with the help of rules, requiring a certain number of implemented activities from a certain number of areas. In this sense, this model is only partly normative as it gives the freedom to choose among the activities to be implemented with the next step. Clearly, the model was not developed as a normative process in mind (KPMG 2000a)[5].

Note that the Hungarian branch of KPMG did the same survey in 2000 (KPMG 2000b)[6]. However, the size of the two samples was very different, therefore they are not comparable The British research included 423 organisation from all over world, with a turnover exceeding £200 million, whereas in Hungary there were only 30 correspondent organisations.

The Framework Assessment Exercise allows to see graphically how well advanced is an organisation in Knowledge Management. Results are created dynamically and appear right after the questions have been answered.

5 KPMG Consulting (2000a) Knowledge Management Research Report 2000, http://www.kpmg.co.uk/

6 KPMG Consulting (2000b) Tudásmenedzsment Magyarországon felmérés 2000, http://www.kpmg.hu/

The exercise is divided into 10 sections which cover the key areas of knowledge management. These sections are:

1) **Awareness and Commitment**: Shows whether staff understands the concept of knowledge management and whether senior management are committed to its use. (7 questions)
2) **Strategy**: Whether the organisation has committed to a programme of knowledge management improvement and how it is managed to ensure business benefit. (6 questions)
3) **Culture**: Shows whether the behaviours within an organisation enable effective knowledge management. (8 questions)
4) **External Focus**: Demonstrates whether an organisation is attempting to look beyond its own boundaries in order to maximise its business opportunities. (5 questions)
5) **Incentives**: Whether the organisation properly rewards those that support its efforts towards knowledge management. (5 questions)
6) **IT**: Indicates whether the IT in place is sufficient and used effectively enough to support knowledge management. (5 questions)
7) **Maintenance & Protection**: How well the organisation protects and maintains its information and knowledge assets. (6 questions)
8) **Ongoing Assessment**: Whether the organisation measures the impact knowledge management and particularly the management of intellectual assets has on the organisation. (5 questions)
9) **Organisation**: The degree to which the organisational structure supports knowledge management. (10 questions)
10) **Using and Applying Knowledge**: Whether the business actually uses and exploits the knowledge inherent in the company in an effective manner. (4 questions)

2.2.3 The IT Advisor for Knowledge Management

Microsoft relies on a “Knowledge Management Landscape” in its IT Advisor series, with a free software tool. Microsoft describes an **eight-level maturity model** starting from “unaware” up to “leadership”.

Their underlying philosophy is: “The framework is based on the premise that organisations typically progress through a series of stages in using knowledge-management tools and techniques. During this process, the major focus of using knowledge management evolves from efficiency to effectiveness to growth. At the same time, the base of know-how and technology within the enterprise grows through a combination of learning from other organisations’ experiences and experimentation”.

In order to position a firm in this model, Microsoft gives 77 evaluation criteria on the current practices. Each criterion is measured on a four-level scale from poor to excellent. Criteria are classified into 20 categories, categories are grouped into 3 areas. Having scored the different criteria, with the help of certain rules the firm is ranked in the “landscape”, and prescriptive measures are proposed (Microsoft 1999)[7].

The software tool provided by Microsoft allowed individuals to score existing practices separately. Also, consolidation of such scores was supported. Therefore the usage of the software tool enabled the managers of the organisation to share their views.

2.2.4 The Quality Management Maturity Grid

Crosby developed a quality management maturity grid in which he listed five stages of management's maturity with quality issues. These five are Uncertainty, Awakening, Enlightenment, Wisdom and certainty. In the first stage, management fails to see quality as a tool; problems are handled by "firefighting" and are rarely resolved; there are no organized quality improvement activities. By the last stage, the company is convinced that quality is essential to the company's success; problems are generally prevented; and quality improvement activities are regular and continuing.

Measurement categories	**Stage 1 Uncertainty (Ad hoc)**	**Stage 2 Awakening (Repeatable)**	**Stage 3 Enlightenment (Defined)**	**Stage 4 Wisdom (Managed)**	**Stage 5 Certainty (Optimizing)**
Management understanding and attitude	Information quality is not considered a management tool. Management tends to blame data administration or information services for "information quality problems" or vice versa.	Management recognizes that information quality management may be of value but is not willing to provide money or time for it.	Through the information quality improvement program, management learns more about quality management; it is becoming more supportive and helpful.	Management is participating. It understands the principles of information quality management and recognizes its continuing role.	Information quality management is considered an essential part of the company system.

7 Microsoft (1999) IT Advisor for Knowledge Management, http://www.microsoft.com/enterprise/building/advisor/KM/index.asp

Information quality organization status	Data quality is hidden in application development departments. Data audits are probably not part of the organization. The emphasis is on correcting bad data.	A stronger information quality role is "appointed" but the main emphasis is still on correcting bad data.	All assessment is incorporated and managers have a role in developing applications.	The information quality manager reports to a chief information officer. Status reporting and preventive action are effective. The organization is involved with business areas.	The information quality manager is part of the management team. Prevention is the main focus. Information quality is a key consideration in all activities.
Information quality problem handling	Problems are dealt with as they occur. There is usually no resolution due to inadequate definition. Conflict is common.	Teams are set up to attack major problems. Long-term solutions are not solicited.	Communication on corrective action is established. Problems are faced openly and resolved in an orderly way.	Problems are identified early in their development. All functions are open to suggestion and improvement.	Except in the most unusual cases, information quality problems are prevented.
Cost of information quality as a percent of revenue	Reported: Unknown Actual: 20%	Reported: 5% Actual: 18%	Reported: 10% Actual: 15%	Reported: 8% Actual: 10%	Reported: 5% Actual: 5%
Information quality improvement actions	There are no organized activities, and understanding of such activities is lacking.	Motivational short-term efforts are made.	Management implements a 14-point program. It thoroughly understands and establishes each step.	A 14-point program is continuing and benefits are starting to be optimized.	Information quality improvement is a normal and continued activity.
Summation of company information quality posture	"We don't know why we have problems with information quality."	"Is it absolutely necessary to always have problems with information quality?"	"Through management commitment and information quality improvement, we are identifying and resolving our problems."	"Information quality problem prevention is a routine part of our operation."	"We know why we do not have problems with information quality."

Table 2-1 The Quality Management Maturity Grid

2.2.5 The Siemens Knowledge Management Maturity Model

The Siemens' KMMM® is a structured method to assess an organization's overall position in Knowledge Management[8].

KMMM consists of an analysis model, a development model and a defined assessment process. The analysis model helps the KMMM consultant to take account of all important aspects of Knowledge Management and reveals which key areas and topics should be developed in future. The development model provides information as to how the respective key areas and topics can be best developed to reach the next maturity level. The assessment process structures all relevant steps from assessment definition to result interpretation.
This deliberately designed model allows both, qualitative and quantitative outputs on the current status of knowledge management in an organization.

The development model defines five maturity levels of knowledge management:

1. **Initial**: KM activities are non-systematic and ad-hoc. No language for describing organisational phenomenons from a knowledge point of view.
2. **Repeated**: Pilot projects and single activities labelled as „KM".
3. **Defined**: Standardized processes make creation, sharing and usage of knowledge efficient.
4. **Managed**: Creation, sharing and usage of knowledge is organizationally integrated and improved (measurement!).
5. **Optimising**: KM is developed continuously and self organized.

This idea is based on the levels of the CMM (*Capability Maturity Model*) of the Software Engineering Institute at Carnegie Mellon University. The names of the levels were adopted from this concept. However, the transfer to the domain of knowledge management represents a completely new development. The maturity levels should be seen as relatively robust states of an organization which are based on in-place activities and processes practiced over time.

With regard to the interventions for developing knowledge management, KMMM suggests concentrating on reaching the *next* higher maturity level. The model does not allow for "skipping" a level, as it is highly improbable that the level will be retained for long. Rather, a synchronous development of the individual key areas seems far more sensible. This means focussing on weaker key areas first with suitable actions before starting a further, integral development to the next level up.

The maturity levels have been defined independently of specific Knowledge Management activities and conditions.

[8] Karsten Ehms, Dr. Manfred Langen: *Holistic Development of Knowledge Management with KMMM®.* Siemens AG / Corporate Technology. Knowledge Management & Business Transformation.

Perspective	Key distinction				Key area pair		
Time horizon	strategic	vs.	operative	→	Strategy, Knowledge Goals	vs.	Leadership, Support
Knowledge	external	vs.	internal	→	Environment, Partnerships	vs.	Knowledge Structures, Knowledge Forms
Actor	people	vs.	technology	→	Staff, Competencies	vs.	Technology, Infrastructure
Rules	informal	vs.	formal	→	Cooperation, Culture	vs.	Processes, Roles, Organization

Table 2-2 4 Key KM Distrinctions

Four "key distinctions" (see figure above) help defining an initial assignment of organizational phenomena and activities which leads to a rough classification of our eight key areas of knowledge management.
These eight key areas are based on the enablers of the EFQM (European Foundation for Quality Management) model and have been extended or differentiated to represent KM-specific aspects. On the next level of the analysis model, 64 knowledge management topics are described, which drill deeper into organizational practices supporting Knowledge Management.

The implicit results of using the KMMM generally include:

- fruitful communication and improved mutual understanding of different views on Knowledge Management problems and solutions,
- understanding and appreciation of a gradual and holistic development of knowledge management,
- motivation of the participants to improve knowledge management.

In the explicit results of the process we can distinguish between quantitative and qualitative results. The maturity ratings of the individual topics are condensed into one maturity level for each key area. The maturity levels of the eight key areas can be represented in a polar diagram. This produces the organization's maturity profile. This profile already provides the first indications which key areas are to be developed primarily and which level is to be aimed at.

For targeted development of knowledge management the qualitative results of the KMMM methodology are of crucial importance. Once the assessment process is completed, the general concepts of the KMMM on knowledge management are underpinned with specific examples from real “organizational” life. These results contain the valuable information which can be used by an organization to improve its knowledge management.

2.2.6 The Knowledge Formula

The “VISION KMMM” (V-KMMM) for user communities has been inspired by the Knowledge Formula as developed by Gallagher and Hazlet.

Gallagher and Hazlet are performing an ongoing research programme targeted at developing a Measurement and Evaluation Tool for KM Maturity in Organisations. At the basis of the study Gallagher and Hazlet developed the Knowledge Management Formula (KMf) as outlined in the following figure.

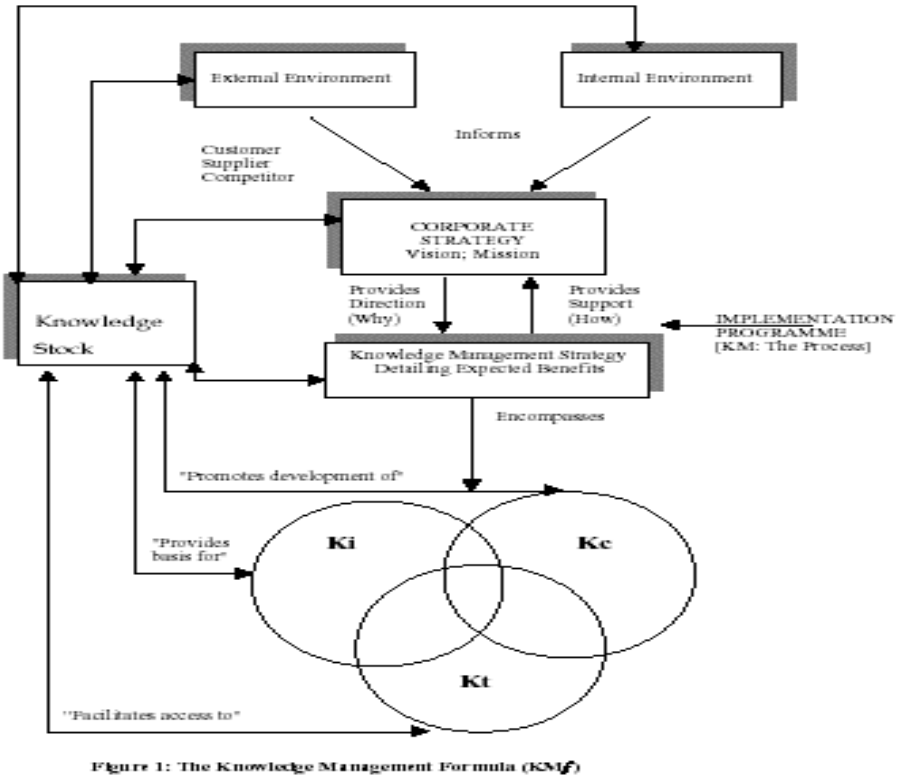

Figure 1: The Knowledge Management Formula (KMf)

Figure 2-2 The Knowledge Formula Maturity Model

The Knowledge Formula (Kf) has been elaborated developing the so-called K3:

Ki = Organisational Knowledge Infrastructure
Kc = Knowledge Culture
Kt = Knowledge Technology

Such an approach reflects in a structured and transparent manner the various elements related to both technological, organisational and human aspects to determine the level of maturity within user communities. As such the K3 formula provides an practical basis for the VISION project to evaluate user groups maturity within the context of a selected set of future user scenario’s that forecast the next generation Knowledge Management in the context of actual user group settings.

Some of the following questions might be taken into account when determining the Knowledge Management Maturity level of user communities:

Technology related (Kt)

- What is the technological infrastructure available within the majority of the users in the community
- Is the community aware of core enabling KM technologies (e.g. semantic web technologies, knowledge discovery, etc.) or already uses one of these technologies/ integrates KM technologies with the existing technological infrastructure?
- To what extend are required Knowledge Management applications implemented within the user community

Organisational Infrastructure related (Ki)

- To what extend have business processes and related knowledge management processes been mapped and documented (e.g. using digital visualisation tools or not)
- Are the knowledge-intensive business processes, the information about the processes themselves and the knowledge carriers identified?
- Are these knowledge-intensive processes supported by the use of modern KM technologies or a combination of KM technologies with existing workflow management systems?
- Are there organisational structures and practices in place to enhance Knowledge sharing (rewarding, KM manager)
- Are there strategies/ best practice business rules for the successful introduction and maintenance of KM solutions in a company, the common understanding of the role of KM for the daily business?

Human and culture related (Kc)

- To what extend is Knowledge Management software actually used within the user community and what is the level of experience in using KM Applications
- To what extend is Knowledge Management an accepted concept and perceived as an added value within the user community (KM culture)
- Does the user community have organisational instruments and methods to overbear organisational barriers?

2.2.7 The KMM Model from Infosys Technologies

The KMM Model has been developed by Infosys Technologies and is based on the SEI's Capability Maturity Model (CMM). It defines the five KM maturity levels ***Default, Reactive, Aware, Convinced*** and ***Sharing***. Each of the five maturity levels "is characterized by certain observable capabilities along each of the three major prongs **People, Process** and **Technology**". Furthermore the model has a set of Key Result Areas (KRAs) for each level. Each KRA is specific to one of these three prongs and represents at a given maturity level the organization's observable KM capability at that level. In this model the knowledge life cycle is appreciated as consisting of the three stages

- *Knowledge Acquisition / Updation*
- *Knowledge Sharing / Dissemination*
- *Knowledge Reuse*

whereas each of the maturity levels is characterized with regard to the effectiveness of each of these stages. The following two tables depict the five maturity levels of the KMM Model as well as the KRAs by level [KOCH00].

Level		***Organizational Capability***
Level 1	Default	• Complete dependence on individual skills and abilities
Level 2	Reactive	• Ability to perform tasks constituting the basic business of the organization repeatably.
Level 3	Aware	• Restricted ability for data-driven decision-making • Restricted ability to leverage internal expertise. • Ability to manage virtual teams well
Level 4	Convinced	• Quantitative decision-making for strategic and operational applications widespread. • High ability to leverage internal and external sources of expertise. • Organization realizes measurable productivity benefits through knowledge sharing • Ability to sense and respond proactively to changes in technology and business environment
Level 5	Sharing	• Ability to manage organizational competence quantitatively; • Strong ROI-driven decision making • Streamlined process for leveraging new ideas for business advantage; • Ability to shape change in technology and business environment.

Table 3: Level–Organizational Capability Mapping, Source: [KOCH00]

Level	*People*	*Process*	*Technology*
Level 1 – Default	--	--	--
Level 2 – Reactive	***Knowledge Awareness Information***	***Content Capture Basic***	***Information Management***
Level 3 – Aware	***Central Knowledge Organization Knowledge Education***	***Content Structure Management***	***Knowledge Technology Infrastructure***
Level 4 – Convinced	***Customized Enabling***	***Content Enlivenment*** ***Knowledge Configuration Management*** ***Quantitative Knowledge Management***	***Knowledge Infrastructure Management***
Level 5 – Sharing	***Expertise Integration Knowledge Leverage Innovation Management***		

Table 4: KRAs by level, Source:[KOCH00]

3 The Vision Knowledge Management Maturity Model

Within the "VISION KMMM" (V-KMMM) the two dimensions of maturity levels (RTD oriented and organisation oriented) have to be combined into a single model in order to be able to develop research and development scenarios and implementation paths that take into account both technology development and user maturity. Both are required to involve users (groups) in the development of the next generation KM.

3.1 Applying the RTD oriented MM

The application of the RTD oriented Maturity Model Approach to the VISION KM scenarios consists of four major phases:

1. the *Extraction of Technology Prognoses from each Scenario* which we have developed and analysed in the VISION Roadmap Document D4.1;
2. the *extraction of technology prognoses from each scenario*;
3. the *consolidation and sorting of technologies;*
4. the *Definition of Maturity Levels;*
5. the *Development of Technology Life Cycles for each technology.*

The phases are described in detail as follows:

3.1.1 Phase 1 - Extraction of Technology Prognoses from each Scenario

The developed expert-based roadmaps from deliverable D4.1 which are based on the four disjoint key scenarios

- Enterprise Knowledge Portals in Action
- Mobile Knowledge Access and Usage
- Gathering Knowledge from the Web
- Knowledge Sharing in Smart Organisations

provided an expert-based consensus view of the future science and technology landscape concerning next generation knowledge management. In order to analyse the scenarios we defined a short-term (2003-2004), medium-term (2004-2007) and long-term (2008-2010) timeframe as well as the following three levels of evolution of specific technologies along a timescale from now until the year 2010:

- Basic Research (n + 4)
- Applied Research (n + 3)
- Software Technology (n + 2)

The following figures indicate the results of the four roadmaps from which we respectively extracted technology prognoses.

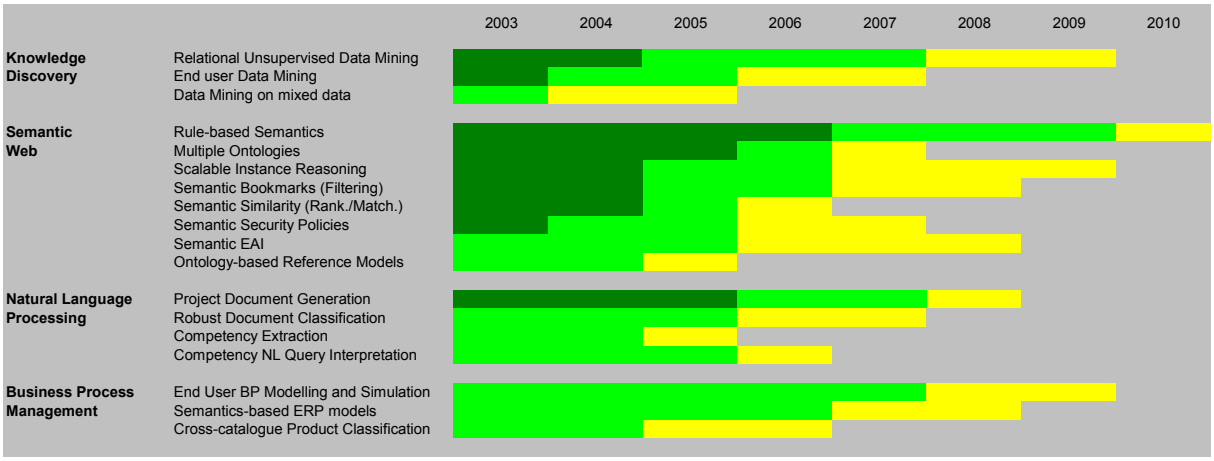

Figure 3-1: Scenario I - Enterprise Knowledge Portals in Action

Figure 3-2: Scenario II - Mobile Knowledge Access and Usage

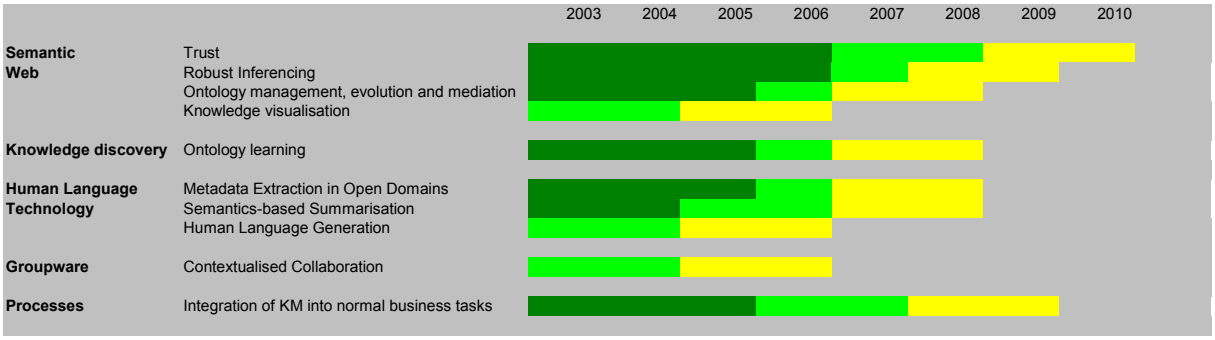

Figure 3-3: Scenario III - Gathering Knowledge from the Web

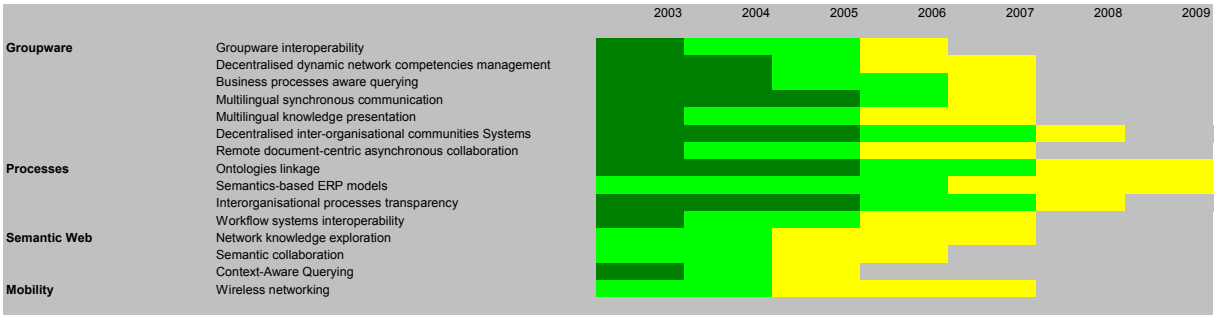

Figure 3-4: Scenario IV - Knowledge Sharing between Smart Organizations

3.1.2 Phase 2 - Consolidation and Sorting of extracted Technologies

In a next step we consolidated and sorted the extracted technologies over all four scenarios in order to have a basis for defining the maturity levels. Figure 3-5 illustrates how we derive a technology-oriented overview by combining the individual Technology Prognoses (TP) stated before distributed in the four scenario roadmaps.

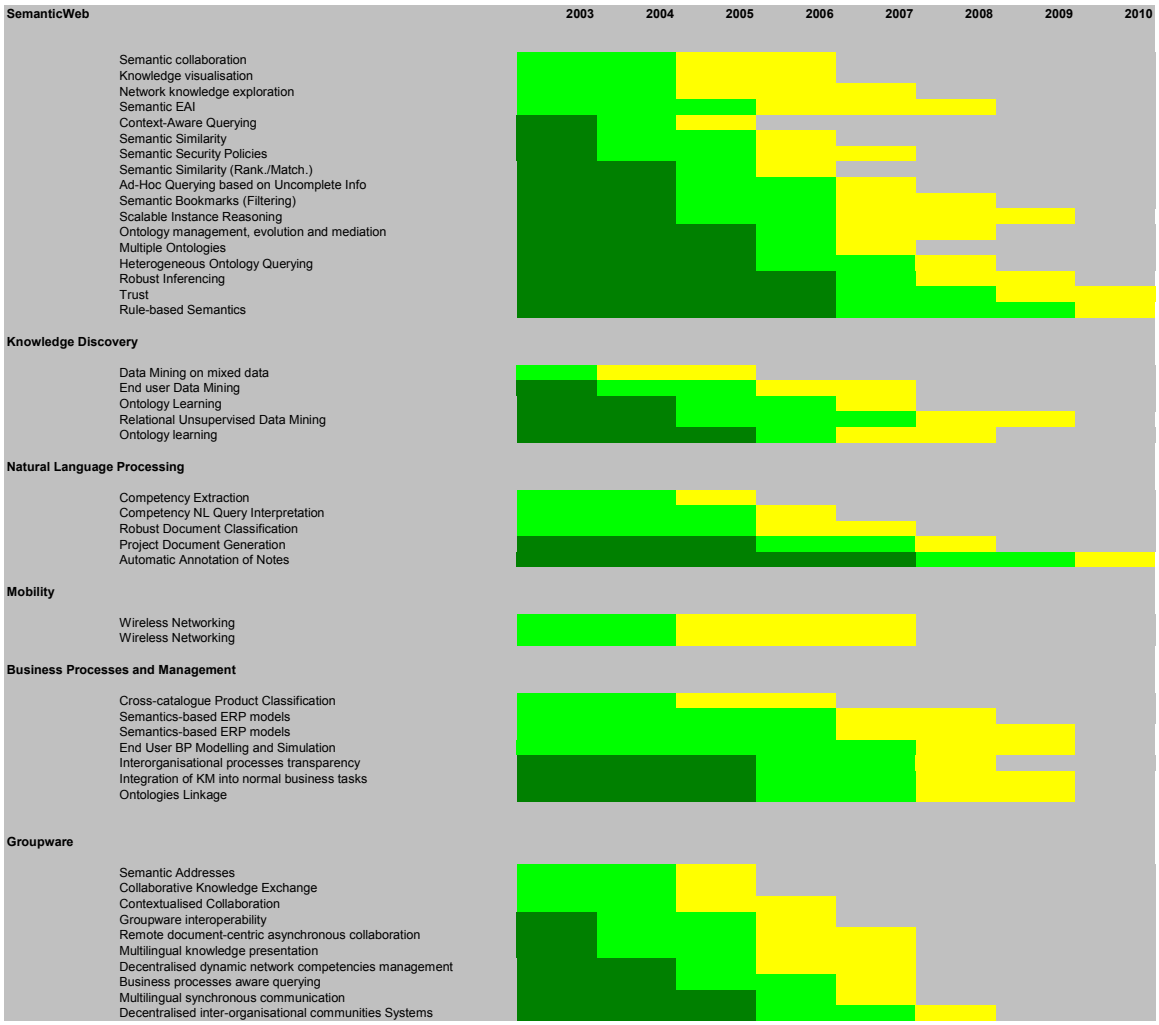

Figure 3-5: Consolidation and Sorting of extracted technologies

3.1.3 Phase 3 - Definition of Evolution Levels

The VISION KM Maturity Model approach builds on the maturity model for technology development as applied in the IST programme within the Fifth Framework Programme. Depending on the evolution level of technology different types of projects will be required to advance towards the next step of innovation.

Please refer to paragraph 2.1. for a description on the RTD oriented maturity model.

In this phase we identified three technology evolution levels for each of the VISION key enabling technology. We distinguish between the following three maturity levels.

High Evolution Level	
Middle Evolution Level	
Low Evolution Level	

The following figures show the average evolution levels (average times of research in years) over all technology prognoses for each KM key enabling technology.

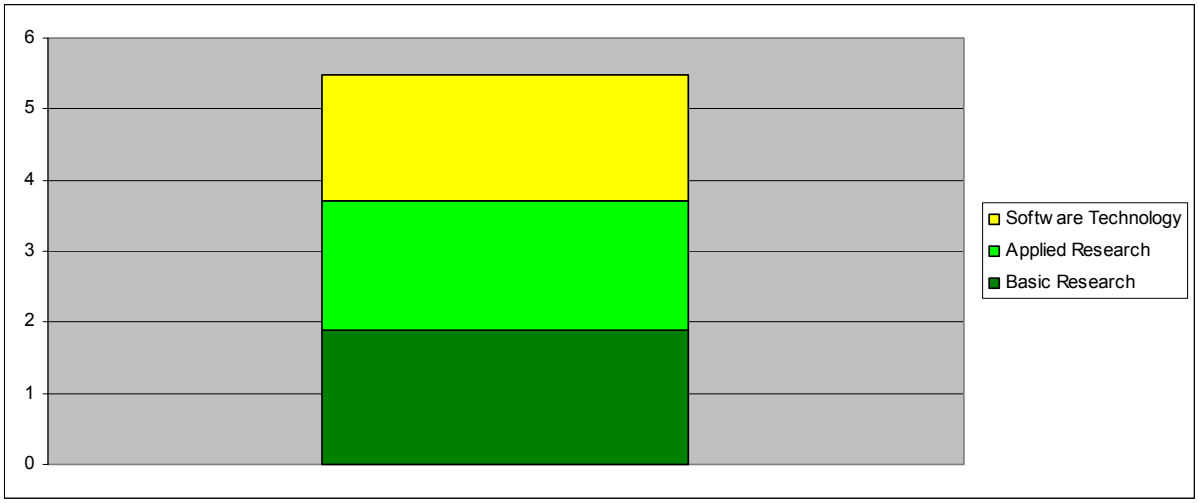

Figure 3-6: Evolution Level - Semantic Web

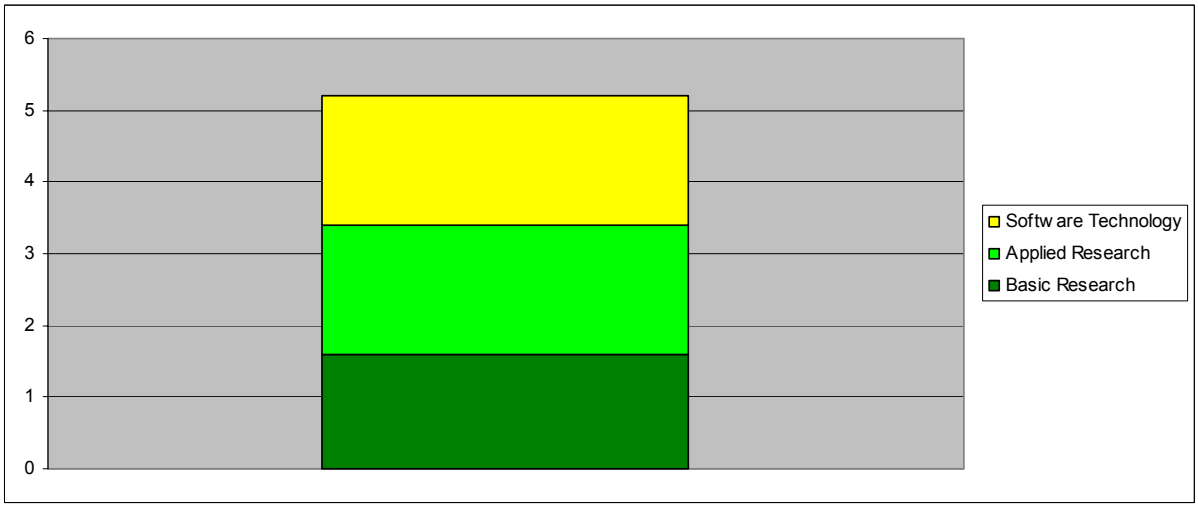

Figure 3-7: Evolution Level - Knowledge Discovery

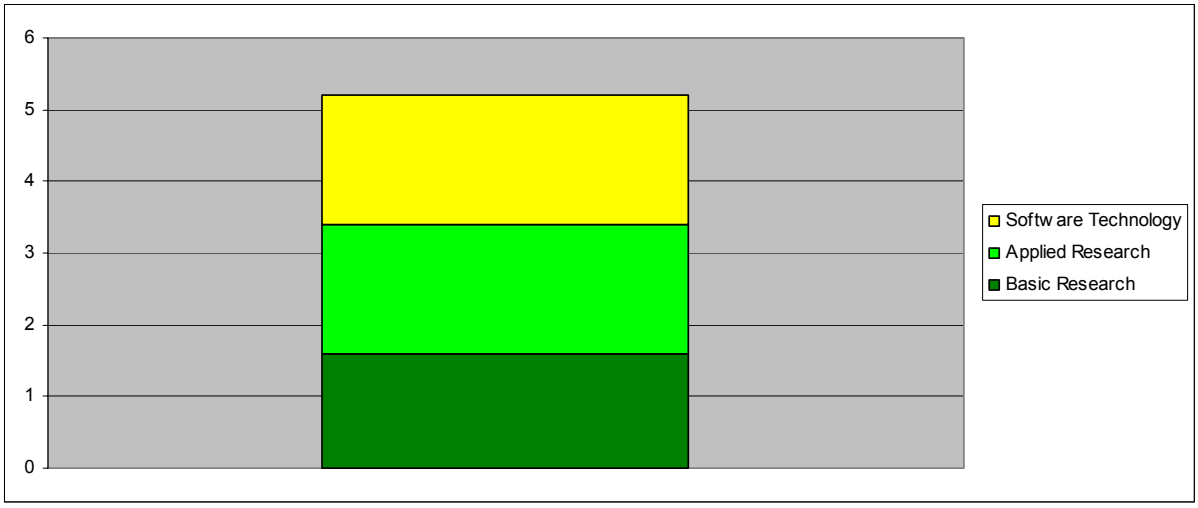

Figure 3-8: Evolution Level - Natural Language Processing

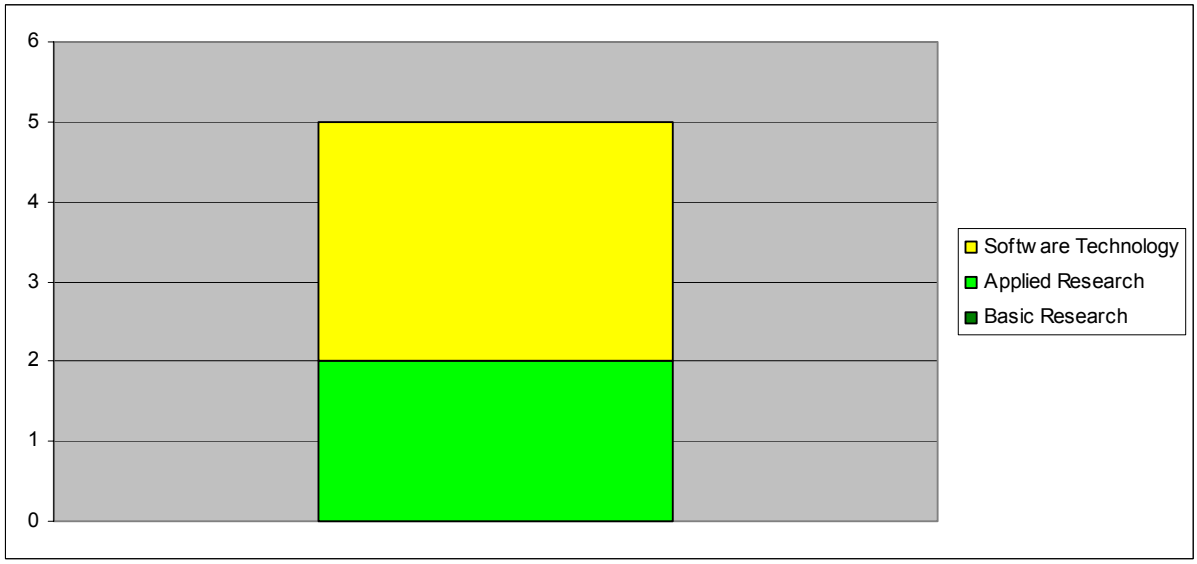

Figure 3-9: Evolution Level - Mobility

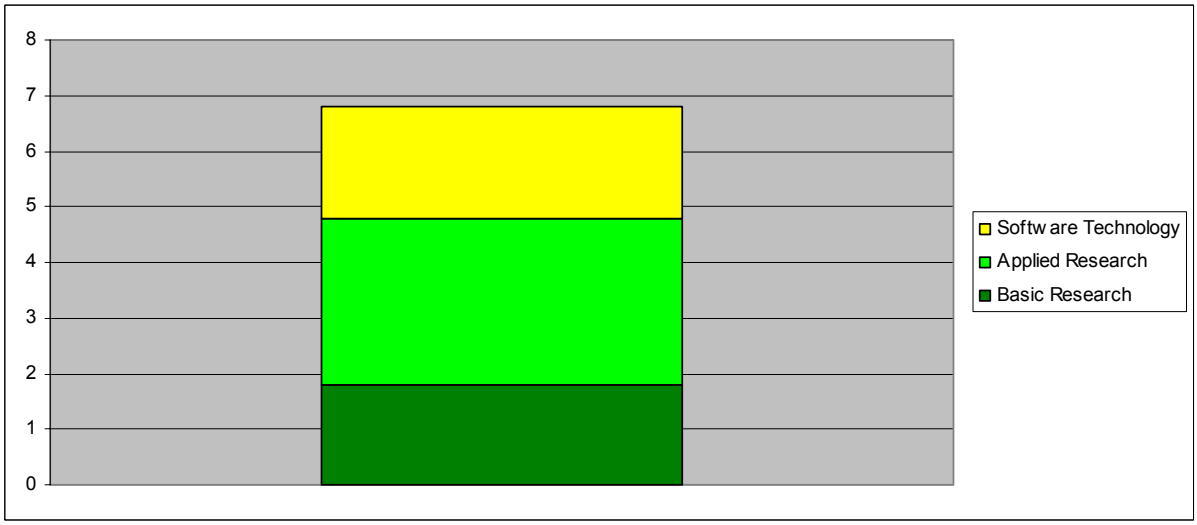

Figure 3-10: Evolution Level - Business Processes and Management

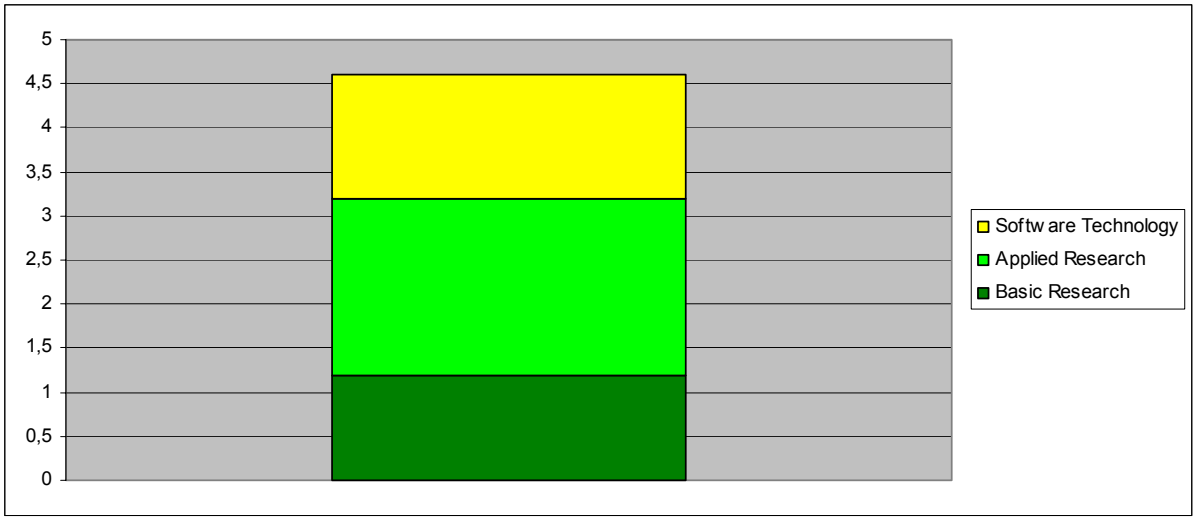

Figure 3-11: Technology Evolution Level - Groupware

3.1.4 Phase 4 - Development of Technology Life Cycles

Finally we developed technology life cycles for each technology cluster and combined them with the defined maturity levels for each technology. This has been realized by analysing every single technology prognosis for a specific key enabling technology, developing a technology life cycle for it and after that averaging over all developed technology life cycles. The technology lifecycles are represented by normal distributions which are illustrating the adoption of a particular technology. The centre and range of the normal distribution curve are ascertained by averaging over the cumulated years for expected research needs from all technology prognoses. The following figures show technology life cycles for each KM key enabling technology.

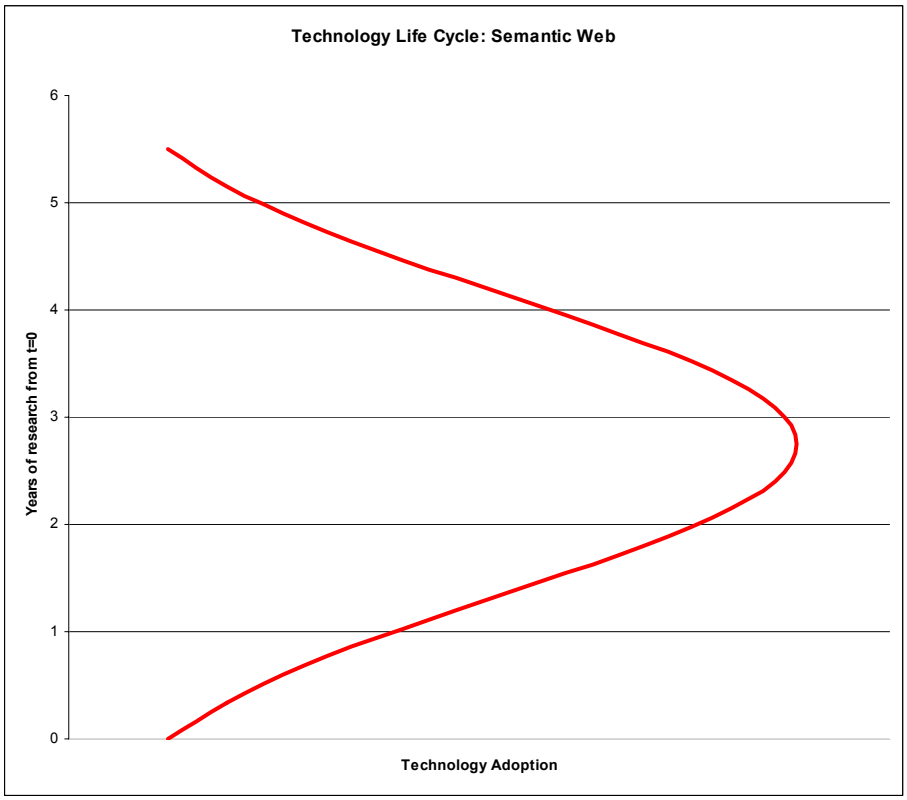

Figure 3-12 Technology Life Cycle - Semantic Web

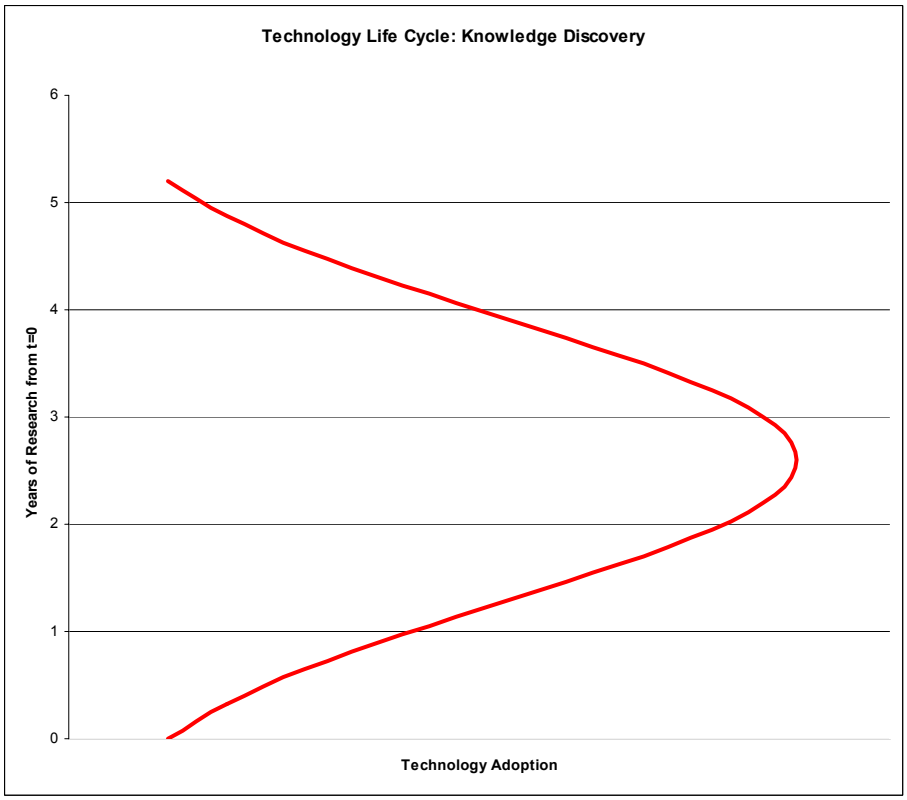

Figure 3-13: Technology Life Cycle - Knowledge Discovery

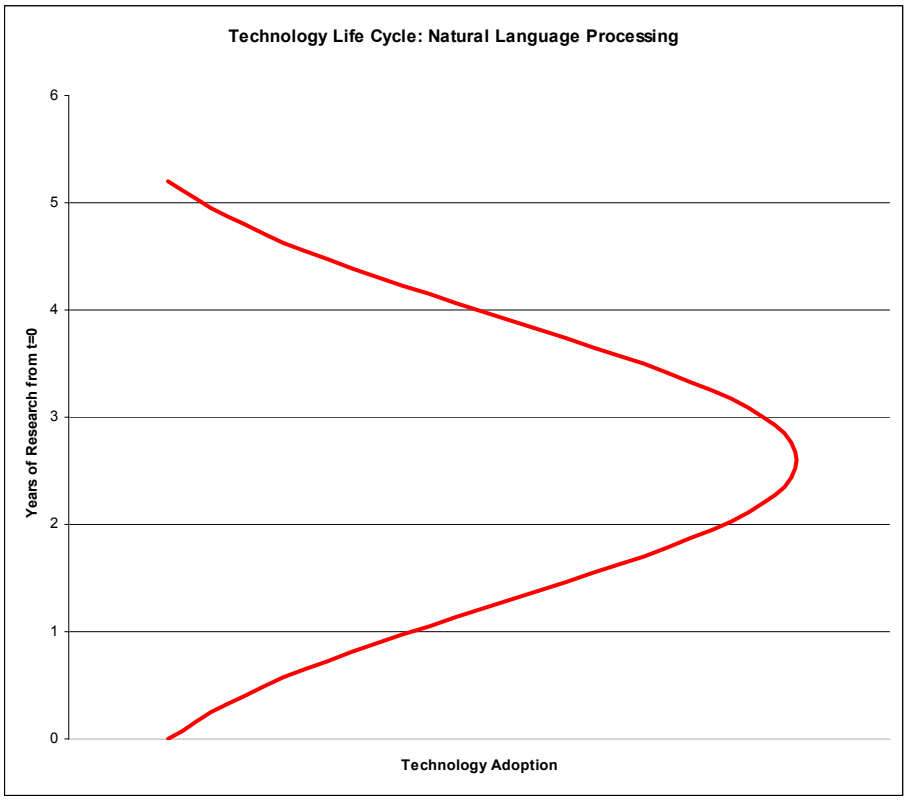

Figure 3-14: Technology Life Cycle -Natural Language Processing

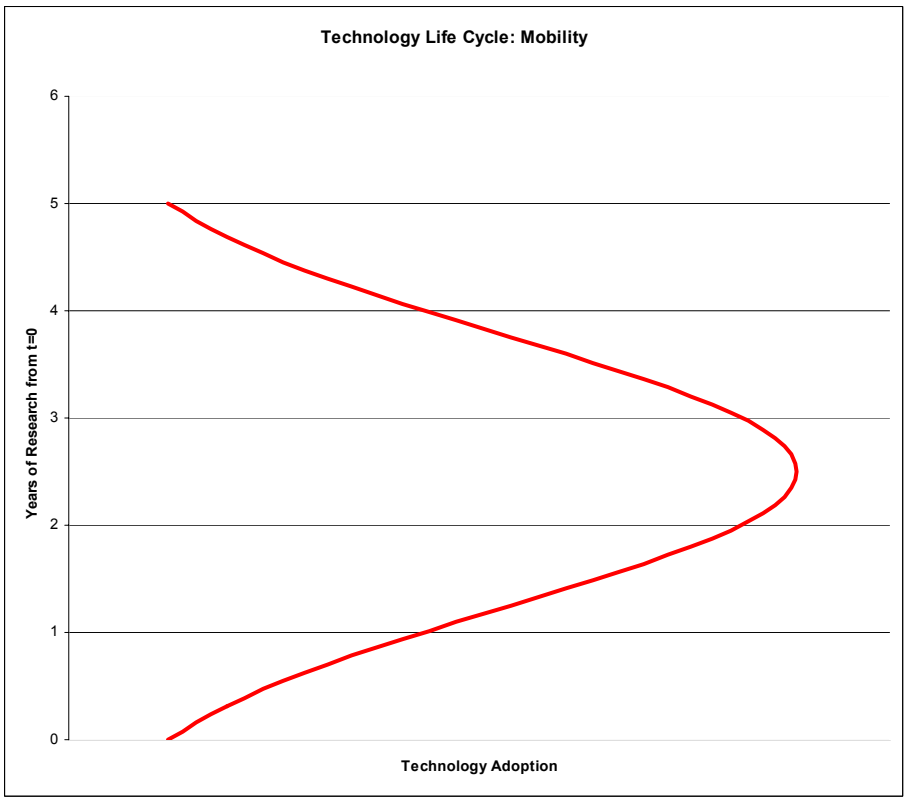

Figure 3-15: Technology Life Cycle - Mobility

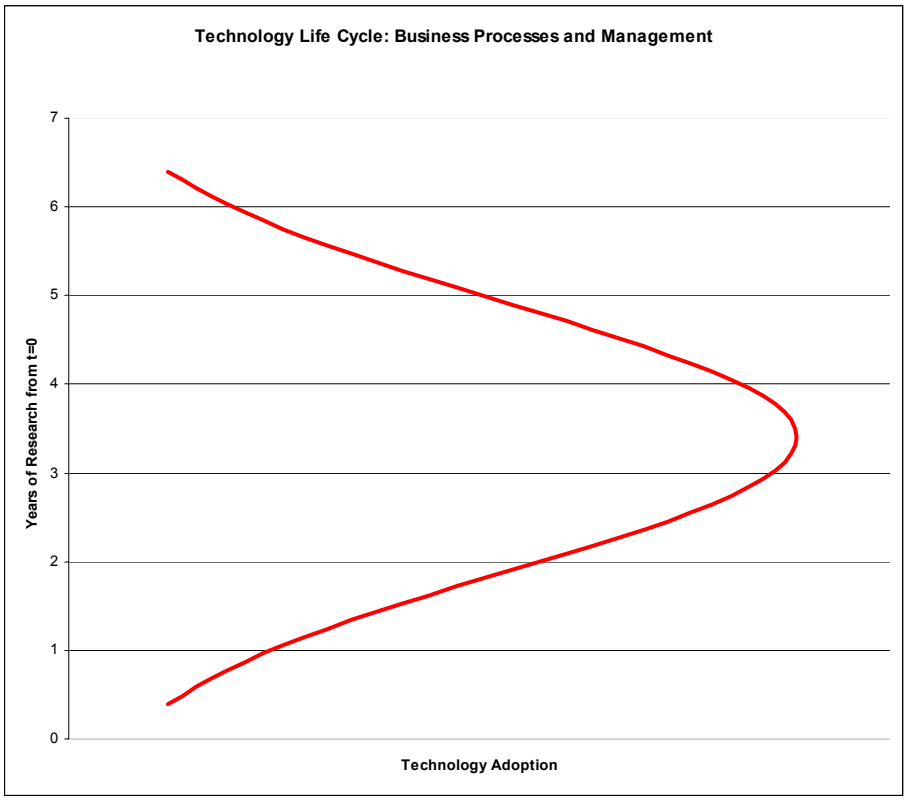

Figure 3-16: Technology Life Cycle - Business Processes and Management

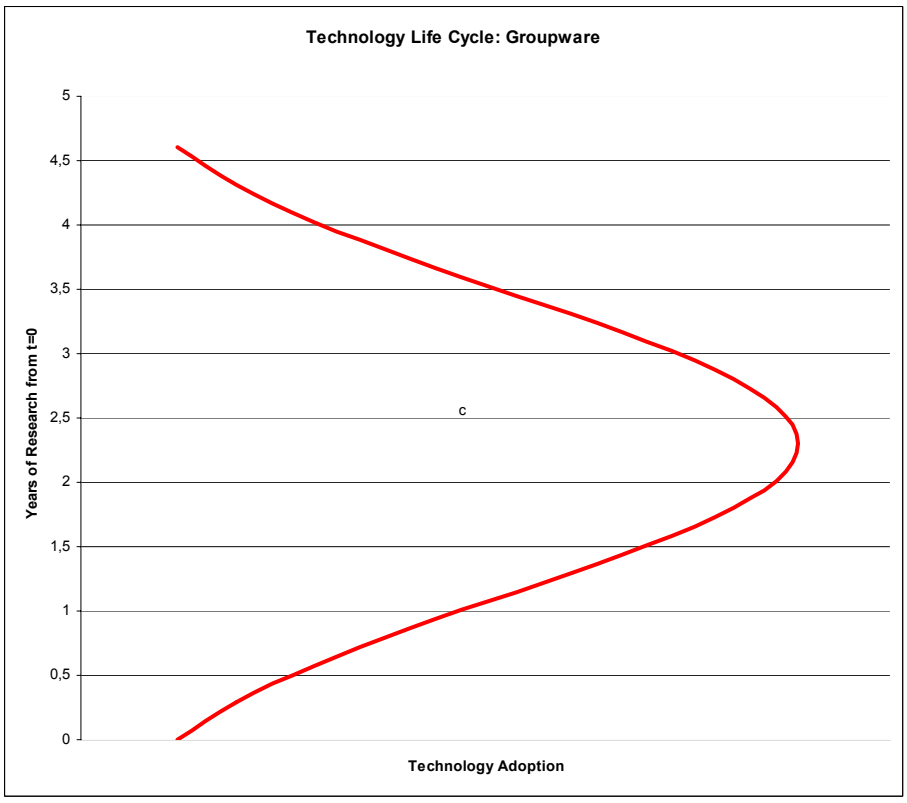

Figure 3-17: Technology Life Cycle - Groupware

Figure 3-16 summarizes the four phases of the VISION KM Maturity Model Approach and their interaction, as described above.

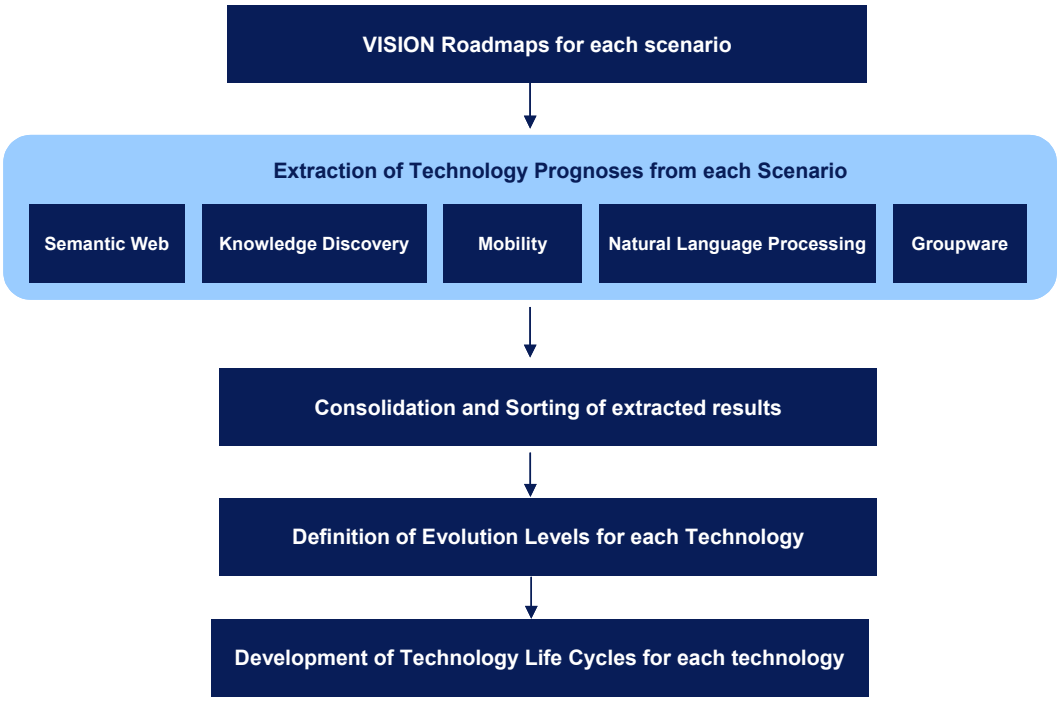

Figure 3-18 Applying RTD oriented MM to VISION

3.2 Applying the organisation oriented MM

The VISION approach is modelled on the Knowledge Formula Maturity Model (see paragraph 2.6.). However, detailed assessments of user groups may involve multiple Maturity Models to quantify the required level of maturity of user groups in detail.

Figure 3-1 provides a simple model on how distribution of maturity levels within a user community can be divided in four main categories.

The four main Maturity Levels presented in the quadrant are the following:

1. **Kf-0**: The user group has no Ki, Kt and Kc to support future generation KM
2. **Kf-1**: The user group has predominantly Ki and no Kt and Kc to support future generation KM
3. **Kf-2**: The user group has predominantly Kt and Kc but no Ki to support future generation KM
4. **Kf-3**: The user group has Ki, Kt and Kc to support future generation KM

Hence figure 2-1 indicates the four possible user Maturity Levels based on the Knowledge Formula model. In order to move forward towards people oriented next generation KM, highly mature users (groups) need to be involved in the research and development initiatives. The yellow area indicates this targeted maturity level of the user groups to be involved in developing and implementing next generation KM solutions.

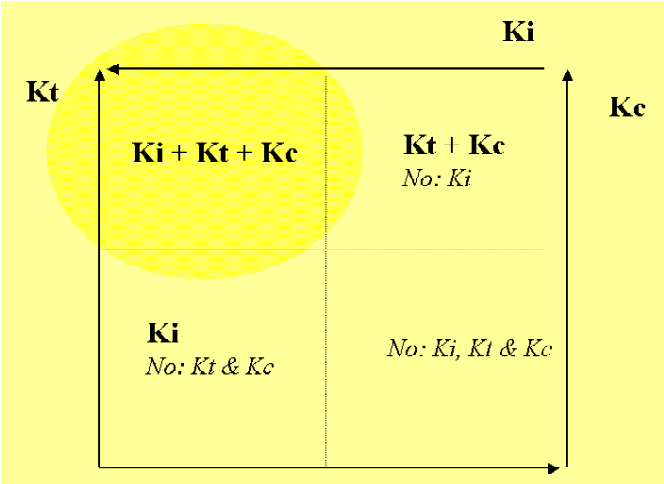

Figure 3-19 V-KMMM user group Maturity levels

However, depending on the specific next generation KM user scenario to be developed as a basis of the RTD roadmaps, some users (groups) may not be ready to participate to the targeted research initiatives due to an insufficient KM maturity level. In such cases, depending on the level of Maturity, different support actions within future KM research and development activities will be necessary to develop and validate next generation KM and accelerate the uptake of KM technologies and practices.

For each set of KM related technologies within a specific user community a V-KMMM Maturity Map can be developed indicating:

1. **What is the maturity level of a user community (organisation oriented MM):**

    a. How is the distribution of maturity within a user community
    b. How “advanced” are the most advanced users within a community
    c. What is the critical mass of users with a sufficient level of maturity to experiment with novel KM developments

2. **What is the maturity level of a specific group of relevant KM technologies within the user context (RTD oriented MM):**

    a. What are the next steps in technology innovation within this specific user community
    b. What type of trial and Best Practice actions are valuable to stimulate the take-up of the relevant technologies within this user community

3. **Combined maturity issues (“scenario oriented” MM)**

    a. How much effort will be required in Research and take-up actions to advance this user community towards the targeted VISION of a next generation Knowledge Management (KM scenario’s as an objective)What organisational and human resource related initiatives have to be deployed to advance towards the VISION of next generation

KM (how to involve SMEs and how to support their take-up towards the next generation KM)

3.3 Implementing the VISION scenario Roadmaps

The V-KMMM is applied in a set of visionary KM user scenario's outlining KM targets for the next 5-10 years. The user scenario's have determined a selection of KM technologies to be developed and implemented in a user community.

The "mission" of the VISION project is targeted at contributing to the development of **people oriented KM solutions**. Currently many KM developments are technology driven (technology push) and take insufficient notice of the actual user communities in which KM technologies need to be applied. In fact one of te key elements mentioned several times in the user needs analyses carried out in VISION is to improve on user friendliness. In this context the VISION consortium believes it important that future research and development initiatives (e.g. IP's) more explicitly take into account the needs and maturity of users (communities). V-KMMM provides a Maturity Model that promotes an RTD approach that focuses research to enhance both technology and users maturity towards more people oriented KM solutions:

1. The technology oriented Maturity approach serves to identify next steps in technology development in order to move towards the state of the future KM technologies (e.g. semantic web technologies)
2. The users oriented Maturity approach serves to assess the state of maturity of a user (group) that will be involved in research and technology development projects towards the next generation KM and improve the capability of researchers to take account of their needs

The VISION KMMM is not designed as a imperative and rigid model for organisations that "should" move to a higher level of Maturity. V-KMMM has been designed with the sole objective to target research towards the next generation KM technologies taking into account user needs and capabilities to participate to a common user driven research programme. V-KMMM proposes to assess the maturity level of users (groups) as far as necessary to move forward with research towards well defined user scenarios and technology developments as proposed by the VISION roadmaps.

Design and implementation of a **user oriented research programme** towards the next generation KM solutions has to take an incremental approach to take into account user needs and perceptions of KM potential. A "more mature" user (group) will more easily understand the potential of state of the future KM solutions than a "less mature" user (group). Therefore being able to obtain valuable feedback from user groups in user needs analyses (basis of the research work) and in order to be able to actually involve these user groups in an incremental process of testing and fine-tuning ng-KM research results, users might sometimes need to be "prepared" and trained to work with the latest KM solutions and to adopt a sufficiently developed KM infrastructure and culture. Research programmes should be designed to take into account these needs by proposing a cycle of activities:

1. Selection of the users (groups) to be involved in the research programme;
2. Identification of the relevant KM technologies to be further developed towards the next generation KM solutions;

3. Assessment of the users (group) maturity level on technological level (which applications used), infrastructural level and knowledge culture in the light of the requirements to participate to the common research programme;
4. Identification of “preparatory activities” needed to establish a sufficiently “aware” and experienced (mature) user group to be able to execute the common research programme;
5. Design detailed research implementation plan.

According to the basic maturity level of a user community more or less research or take-up activities will be needed towards the realisation of the KM VISION.

The following figure indicates how various types of initiatives could develop towards the KM VISION scenarios.

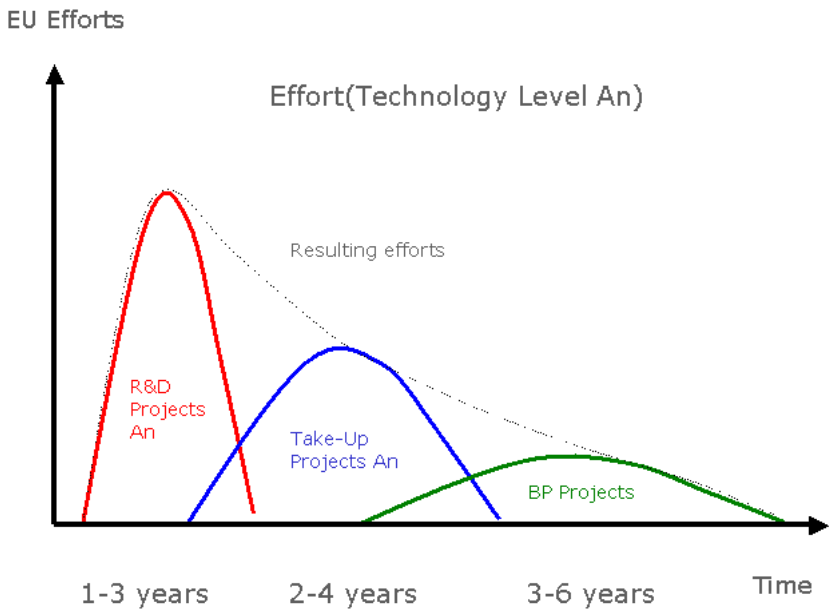

Figure 3-20 First possible RTD actions to VISION ngKM

The example figure indicates a hypothetical (“linear”) situation that requires a substantial effort in research and development towards new and integrated technological solutions towards a specific KM visionary user scenario. As new technologies come available take-up actions on developed prototypes will be needed toward maturity of the technology followed by Best Practice initiatives to further promote take-up.

However – as illustrated above - depending on the maturity level of a specific user community and the targeted KM scenarios the effort division could show to be different as indicated in the following figure.

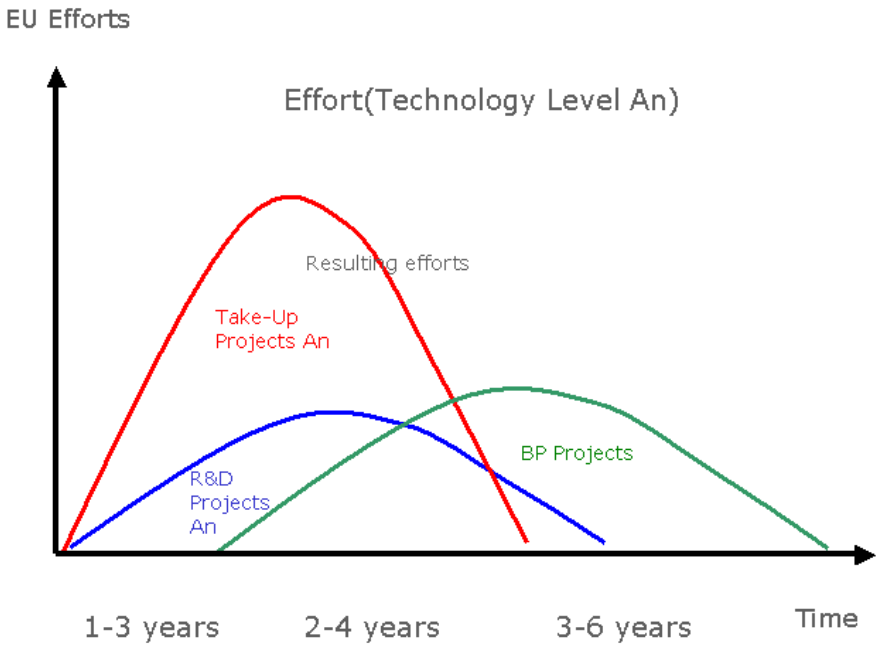

Figure 3-21 Second possible RTD actions towards VISION ngKM

Figure 3-19 might be the consequence of a (low) maturity level distribution in the specific user community that is characterised by a high need for take-up and Best Practice initiatives to advance the user community towards the targeted KM user scenario. In such a situation, technology is largely available but insufficiently used to actually advance towards the next generation Knowledge Society.

The VISION research and technology development roadmaps have been based on 4 user scenarios:

1. VISION Key Scenario I – Enterprise Knowledge Portals in Action
2. VISION Key Scenario II – Mobile Knowledge Access and Usage
3. VISION Key Scenario III – Gathering Knowledge from the Web
4. VISION Key Scenario IV – Knowledge Sharing between Smart Organizations

A first analyses by the VISION consortium of the desired implementation plan for each of these scenarios shows that it is likely for each scenario to require a different implementation path taking into account the specific technologies selected and the user groups to be involved in the scenario realisation. It is generally felt that scenario I is more likely to follow the “linear” implementation model (see figure 3.18) whereas scenario IV will probably require a different approach.

As a consequence the involvement of e.g. SMEs in networked collaboration within the “*Knowledge Sharing between smart organisations*” scenario will require more preparatory actions to “set the stage” for more advanced research and development

programmes. Currently many technologies and applications (e.g. collaboration platforms) are available to support knowledge sharing between networked organisations. However, the VISION consortium partners feel that insufficient practical experience has been gained within different groups of collaborating SMEs to actually practice knowledge sharing. This means that limited capacity is available to actually obtain user requirements and to test and fine-tune new technology developments. Given the availability of in itself mature but insufficiently used technologies, “preparatory assessments and Take-Up actions (including training)” should be carried out in parallel to more state-of-the-future oriented research programmes.

If next generation KM scenarios of people oriented KM together with the acceleration towards a highly competitive Knowledge Society is the focus of EU Programmes further in-depth analyses of the maturity situation will be necessary in order to identify the type and quantity of effort required towards the realisation of the KM scenario’s.

The current roadmapping initiative provides insufficient resources to carry out a complete analyses of maturity levels in various user communities. However, the V-KMMM provides the basis for such an analysis in the first stages of future research initiatives such Integrated Projects in the Sixth Framework Programme.

4 Conclusions

The “VISION KM-Maturity Model” has been developed to provide guidelines for the implementation of the ng-KM research and development scenarios. Implementation of the VISION combined Maturity Model has to be realised through a process.

Starting from the VISION scenarios research and technology development within 5 enabling technologies categories have been identified in order to develop next generation KM applications. Mapping of these enabling technologies against technology maturity levels has been carried out within the VISION Roadmapping project. However, following the V-KMMM, the user group dimension of maturity has to be taken into account when implementing the VISION Roadmaps.

This leads to the need of user group maturity mapping in order to identify accompanying Take-Up projects with targeted user groups to prepare them for experimentation with ng-KM technologies as developed in the VISION roadmaps.

The overall approach can be summarised in the V-KMMM process model that provides a framework for the integration of the technology and user group maturity models. The following figure outlines the V-KMMM process model.

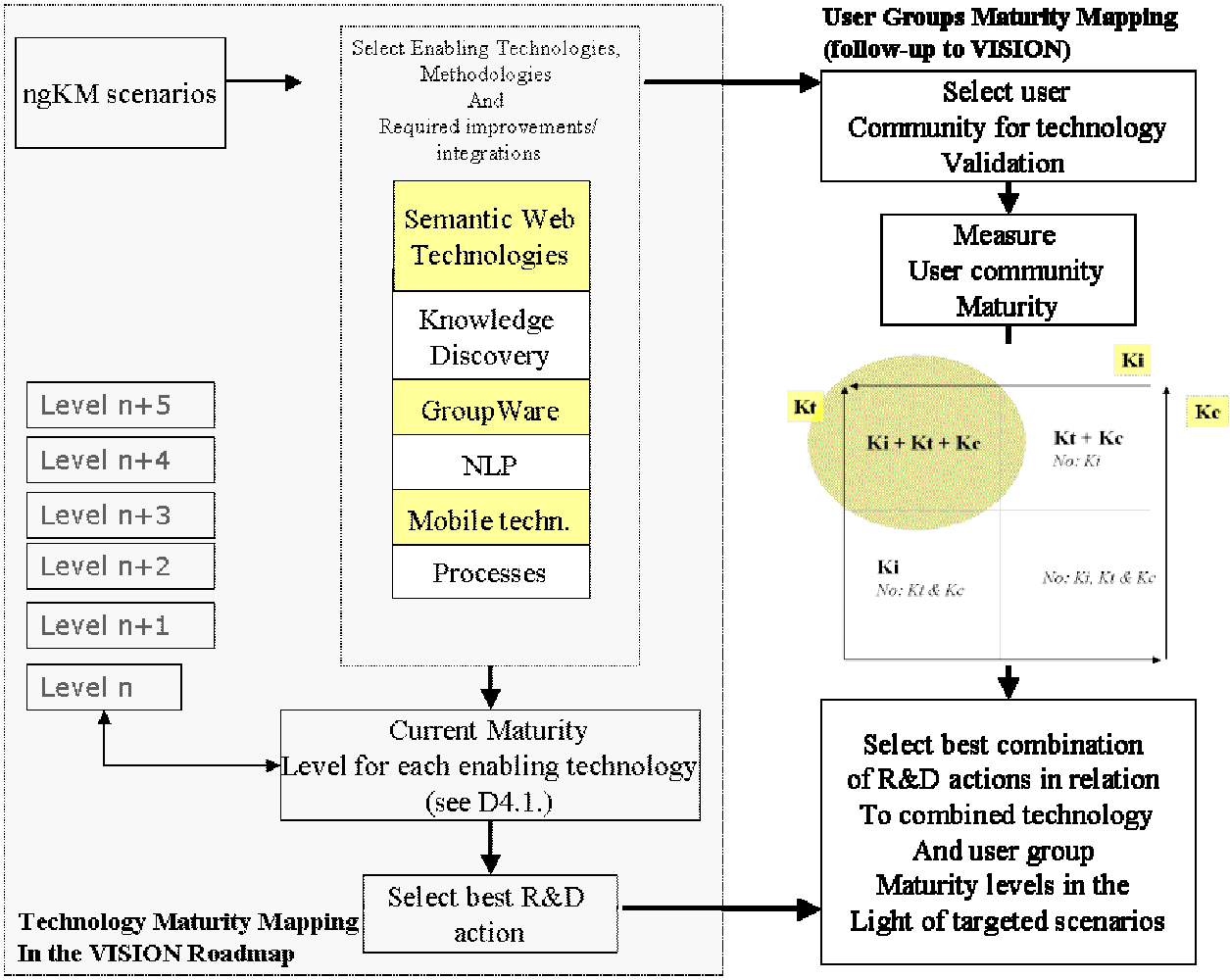

Figure 4-1 V-KMMM process model

The V-KMMM proposes to combine the „classical“ RTD oriented Maturity Model with a user groups oriented Maturity Model. This V-KMMM for user communities has been inspired by the Knowledge Formula as developed by Gallagher and Hazlet. However, different organisation oriented Maturity Models (e.g. Knowledge Formula and Siemens KMMM) may be applied to measure Maturity levels. Moreover, as new Knowledge Management Maturity Models emerge and evolve alternative User Groups Maturity Models may be selected for the implementation of the V-KMMM process model in order to select the best combination of R&D actions in relation to combined technology and user group maturity levels in the light of targeted scenarios.

The V-KMMM process model provides an approach applicable to any KM oriented roadmapping and research programming initiative. The VISION consortium recommends its application for research initiatives that wish to actively involve users (groups) into the design and implementation of the KM oriented research programme sin order to secure effective involvement of users in the specification phase as well as the testing phase of next generation KM solutions.

Finally the VISION consortium recommends to the European Commission to pro-actively promote the identification, implementation and funding of “preparatory measures” (e.g. take-up, training, demonstrations etc.) necessary to progress user communities towards higher KM maturity levels in the context of Sixth Framework programme research initiatives.