Co-Creation Methodologies to Set and Measure Knowledge Value Indicators

Paolo Petrucciani

Co-Creation Methodologies to Set and Measure Knowledge Value Indicators

Paolo Petrucciani (CMC), Epistema di Paolo Petrucciani, Rome, Italy, (epistema@epistema.it)

Snapshot (Quick Learning)

The objective of the paper is to illustrate **a working protocol**, composed of some mixed, cascaded and linked workpaths or phases, utilizing different techniques, tools and methodologies, in order to promote **widespread/collective awareness of** extrinsic or intrinsic **knowledge assets value**.

The methodologies presented are based on collaborative and shared identification criteria of a knowledge value indicators' system, for their subsequent measuring, evaluating and monitoring over time. In this sense the **value of knowledge for a company or organization** is a relative, evolutionary and semi-stable one and may depend mainly on the part of the organization involved in these topical decisions (Sveiby, 2006): top management, experts and/or professionals who each have their own perception of how to measure knowledge (e.g. revenue, profit, quality, culture, organizational alignment, etc.).

The **knowledge value indicators (KVI)** identified make it possible to measure periodically the exchange of experiences and knowledge that take place within a company (Petrucciani, 1990) and to consider at the same time their trend/situation over time to foster mainly:

- knowledge creation, utilization, re-use and their adjustments and alignments for a company's benefit and to increase its value;

- direct organizational initiatives to facilitate knowledge exchange on the job;

- the creation of communities of practices (CoP) and working groups (Dalkir, 2005), also on a semi-permanent basis, based on critical knowledge-sharing;

- organizational and cultural alignment;

- education and training initiatives.

One of the problems you may encounter when starting a KM (knowledge management) project is to achieve agreement about the specific objectives of such a study. There is no simple solution to this issue due to the existence of a multiplicity of possibilities that you can range from, and to the roles and attitudes/behaviour adopted by different sponsors, protagonists and players within a team. Some instruments are outlined below which may facilitate the project workpath, on the grounds of a **consensual and co-created roadmap**, developed step by step, in which continuous insights by participants are focussed on 'what KM processes may imply for the company' and on 'how some knowledge indicators may be explained and utilized for an organization's benefit'.

Context (Where & What)

The general context in which you can use this protocol, using specific methodologies and tools outlined, relates to some company/organization goals to produce rapidly and soundly a clear vision of :

1) which is the relevant core knowledge;

2) how to reach a shared and consensual knowledge asset measurement scale, based on importance, significance or value for the specific organizational context;

3) which are the ways of establishing specific KVI to collect and measure over time;

4) how to track knowledge exchange trends and new knowledge creation/building.

Typical situations, encountered several times and with different clients, prompted me to try to answer, from a KM consulting perspective, the following issues and questions, working on approximations and the continuous improvement of tentative methods. These include:

- **issue-question 1**: the evaluation of knowledge value is initially not clear and/or needs to be stated precisely, at least in terms of benefits deriving from its measurement (e.g. impact on budget or balance sheets, costs, revenues, investments [extrinsic value], its impact on culture/motivation of human resources, as well as its impact on organizational effectiveness [intrinsic value], etc.);

- **issue-question 2**: the absence/scarcity of flexible and hybrid project workpaths necessary to reach more rapidly an awareness of knowledge value in a company or organization, based on co-creation and consensus;

- **issue-question 3**: the scarcity of methodological solutions which are able to permit simple maintenance of the system, with a possibility of introducing various scalable approaches (e.g. measurement scales, rankings reviews, output interpretation, etc.) to ensure the wider solidity of the protocol, even safeguarding necessary adaptability.

While you can use tools and techniques separately to reach a degree of consensus about any of the goals previously outlined , with times and ways to be agreed upon, the **complete four phase joint protocol for an ICT client case**, illustrated in the '*Make it Happen'* section lasted about four months for all the KM project and produced different sessions and timeframes. The number of people involved in the project team and committed to producing expected results were 15-20 (mainly of organizational technical units - sw applications and customer service professional community).

These methodologies and instruments are also applicable, either jointly or separately, in every social or profit/non profit organizational environments in which explicit or tacit knowledge exist, within humans or other assets, and where there is a need to better understand mechanisms to identify, create, maintain and nurture **knowledge value indicators (KVI).** In this sense the number of participants in the situation may vary from 3-4 to 15-30, depending on the complexity and final aim of the project and the required consensus about the issue.

Preparation (The Checklist)

Typical background information for the use of the tools may be various company knowledge databases (e.g. company values, company objectives, core competencies, skill inventory, service

level agreement [SLA], drivers for development strategies, quality indicators, production measures, financial/economic indicators, etc.).

The participants in the project must prepare the set or subsets of the items that need to be investigated and analyzed in various phases. The organization of these data and information is very critical for the success of KM project as is the **selection** of the **knowledge items** in which the project team or top management wants to be engaged. The commitment to produce and share a final vision or relative importance of company knowledge value is essential, and must be applied within the specific context.

In the case of the ICT client illustrated later in this paper, the preparation of material by the project team essentially amounted to a series of dedicated meetings and some back-office preparations beforehand which were assigned to team members and involved:

- the selection of eligible company experts/facilitators, either because of their importance within the organizational, or technical competencies and in-depth knowledge of organization's functioning, from both internal and its institutional clients' perspectives. The objective of the selection process was to identify correctly the best/and most significant knowledge indicators which have a direct impact on generable value by their monitoring over time (e.g. productivity gains, service quality improvements, costs savings linked to larger company know-how diffusion and circulation, system maintenance efficiency, cheapness of collection and monitoring, etc.) (one meeting with top management);

- the selection of basic indicators regarding production processes, quality systems and quality service levels, by type, by identifying the main critical success factors (two meetings of 2 hours, in team).

Toolkit (The Essentials)

In this section there is a summary and brief description of the significance, scope and necessary human interaction for three of the five tools/techniques utilized in the four phase protocol for the identification of **knowledge value indicators (KVI), while the** remaining two are described in terms of their significance only.

critical success factors (CSF) – These are useful indicators and data for top management, initially introduced by Rockart (1979), to evaluate which activities of an organization must be monitored and which characteristics/performance must be reached to ensure robust competition on the market (key business activities). **CSF** are very useful to identify, normally by senior expert panels or directors, which are the critical issues that an organization deals with and wants to track over time. A typical CSF session may take a couple of intensive hours with open discussion in a meeting room, with whiteboard and flip charts, supported by personal insights prepared beforehand . Groups or experts may range from 4 to 10 individuals. Larger numbers require a laptop for collecting and keeping a score of individual points of view (see Table 1, forward).

paired comparison – This technique makes it possible to compare and assess in pairs elements of a square matrix that has same elements on x and y axes and an empty diagonal (David, 1988, Armstrong and Murlis, 1991). **Paired comparison** is normally utilized for clarifying priorities and the relative importance of a sample or complete set to be investigated (e.g. roles, values, competencies, know-how, etc.). Any expert may work on a personal separate sheet to investigate which item is more significant than another using a square matrix. A typical paired comparison session, compiled electronically, may take up to 15-30 minutes, depending on the items to be compared. Managers, professionals or experts may range, in average, from 2 to 30 individuals.

This technique requires a laptop with a pre-compiled worksheet with 'complement to 2 formulae' (see Table 2, forward, instructions at the bottom).

collaboration matrix – This concerns a company organizational units or offices square matrix through the identification of information, knowledge and consulting requests and typical offers between various units/offices, about different issues. **Collaboration matrix** is normally utilized for clarifying, within company organizational units, 'who exchanges what with who' (others units), and makes it possible to track relevant knowledge demand-supply or exchange. A typical compilation for this matrix requires 3-4 hours of individual work by each head/person responsible for the organizational unit, to produce at the end a comprehensive organizational map (normally this compilation is done by PC or laptop with electronic sheets) (see Table 5, forward, instructions at the bottom).

While for **CSF** and **paired comparison** you may use different co-creation facilities, either paper or electronic ones (e.g. expert panels, electronic expert panels using wikis or e-mail, normal open space or small rooms with use of flip-charts or post-it, etc.), the **collaboration matrix** requires an in-depth knowledge of the organizational structure and detailed information about all organizational units under investigation (minimum at first and second layers) and needs to be filled out by paper and pencil or with specific pre-prepared worksheets, with contributions from consultants and all internal managers that know exactly 'which units utilizes which other units' for specific collaborative organizational purposes, from a knowledge demand-supply perspective (e.g. internal procedures, exchange of practice/know-how, internal technical or mutual assistance, etc.).

KPI - key performance indicators – This is a set of quantifiable measures for a company or a sector, utilized to gauge and compare strategic and/or operational performance (variable, both within the company and the industrial sector) (utilized also to measure company critical processes performance).

balanced scorecard – framework and methodology introduced last decade (Kaplan and Norton, 1992, 1996) to represent company result areas and to link strategic company objectives to operational ones, following some predefined classification and/or perspectives (economical-financial, customers, internal business processes, learning and growth)

Making it Happen (The Approach & the Action)

The overall approach outlined below for the ICT client case is basically 'an open source methodology' and adopts a specific protocol, in four phases (Petrucciani, 2006). The tools are described in this section and are also described from a technical perspective in the '*Toolkit*' section. Tangible and measurable objectives of the four phases are summarized.

Deployment and timing of the four phase joint protocol

First phase (knowledge recognition)

The first objective was to extract relevant knowledge items in collaboration with people involved in creating, using and exchanging specific knowledge. So the aim was to select rapidly some factors-indicators that would have made it possible to measure "knowledge value" for the company, both from economic, professional and specialised perspectives.

The activities of this part of the project involved an internal survey to identify which **critical success factors (CSF)** (Rockart, 1979) should be considered that have a direct impact on company services towards core clients focussing specifically on both the company performance profile and internal/external know-how circulation as "principal drivers for investigation". The

methodology utilized to identify these critical factors, subsequently transformed in knowledge value indicators, is the **balanced scorecard (BS)** (Kaplan and Norton, 1996).

Some of the principal **knowledge critical factors (KCF)** were identified in this part of the survey (the overall project team amounted to initially 49 knowledge items, subsequently reduced to 19 knowledge critical factors, of which, 8 were finally selected (for company value and impact), as well as quality system indicators of the company (certification ISO UNI EN 9001: 2002, productive processes) and 4 balanced scorecard perspectives were applied and include:

- economic-financial perspective: company value generation linked to innovative contracts content with existing clients and to traditional/innovative contracts with new clients (where innovative contracts content stands for new or more efficient technological solutions offered)

- customer perspective: applications effectiveness [defectiveness of sw applications under guarantee or not]; average delay of intervention for maintenance of sw applications running; no. of successful solutions vs customer claims inbound calls to first level call center; no. of internal users served by company knowledge base

- internal business processes' perspective: time to market [speed to release new sw products/applications]; tools for sw quality measurement

- learning and growth perspective: quantity of existing technical documentation on running applications; overall active participative level of the specialised forum (under intranet); amount of investments in specific education/training seminars which have the aim of increasing specialised and technologies-methodologies knowledge

A preliminary measurement system and periodical timeframes were then identified for each factor-indicator (Table 1).

Facilities and human interaction: The first phase involved about three meetings of 3-4 hours to produce, using **CSF technique**, a shared and co-created vision of relevant company core knowledge, named temporarily by the team knowledge critical factors (KCF). Facilitation was supported by a room for brainstorming and flipcharts.

Second phase (knowledge ranking)

The second ojective was to rank knowledge items along a shared scale or metrics in a way that there will be general agreed consensus on the final ranking.

In this phase the project team produced a system to validate, evaluate and graduate (rank) selected KCF by means of 'democratic sharing mechanisms', on the basis of 'paired comparison methodology' (David, 1988, Armstrong and Murlis, 1991) that makes it possible to vote the relative internal importance among them.

The team investigated also some **key-criteria** to facilitate the task of collecting and measuring these indicators over time, using the same 'paired comparison' methodology presented before. So the project team produced evaluations and rankings. Individual paired comparison (Table 2) and the two final templates (Table 3, Table 4) are illustrated below as well as report votes-graduations individually and collectively produced by five internal experts. Instructions for compiling the sheet are outlined at the bottom of Table 2. The sheet uses internal formulae for 'complementing to 2' the diagonal bottom-left part of the matrix, following individual choices on the diagonal upper-right part.

Table 1 – First selection of Knowledge critical factors (KCF)

FIRST SELECTION OF KNOWLEDGE CRITICAL FACTORS (KCF)

Balanced Scorecard perspectives	Sw production and assistance	Measurement unit	Periodicity
Internal business processes	time to market: speed to release new products	no. of elapsed working days/produced function points (team work)	yearly
Internal business processes	sw quality	no. of sw corrective interventions on sw applications installed on central systems	quarterly
	Sw application effectiveness	**Measurement unit**	
Customer perspective	defectiveness under guarantee	erros/function points	quarterly
Customer perspective	defectiveness not under guarantee	erros/function points	quarterly
Customer perspective	average delay of intervention on sw applications installed on central systems	time (h)	quarterly
	Documentation system	**Measurement unit**	
Customer (internal) perspective	overall audience served	no. of unique "users" that consult documentation system	monthly
Internal business processes	authors/publishers audience	no. of unique "users" that publish into documentation system	monthly
Internal business processes	quantity of produced documentation	no. of archived and/or published documents into documentation system	monthly
Internal business processes	quality/quantity of thematic archives produced and their increment in time	no. of new thematic folders introduced into documentation system	monthly
Learning and growth	quality/quantity of individual consultation needs	no. of "thematic requests" addressed by internal documentation engine (clustering)	monthly
	Forum	**Measurement unit**	
Learning and growth	active overall participative level	no. of messages and/or active users	monthly
Learning and growth	participative level to overall growth of forum knowledge (FAQ)	no. of significative FAQ (extracted by Forum)	monthly
Learning and growth	collaborative level/dynamic growth of specialistic knowledge exchange	no. of active/stable/permanent communities of professional (CoP)) (experts)	monthly
	Education	**Measurement unit**	
Learning and growth	qualitative (thematic) and total gain of company specialistic knowledge investment	no. of seminars and/or no. of total education/training days and/or no. of total participants	monthly
	Communication/Information	**Measurement unit**	
Learning and growth	general explicit collaboration	no. of meetings/presentations of internal/external experts (tacit knowledge transfer), organized monthly	monthly
Learning and growth	explicit collaboration about defined issues	no. of internal presentations/monthly regarding actual/new projects/initiatives	monthly
	Intranet	**Measurement unit**	
Customer (internal) perspective	general interest to intranet contents	no. of total average users linked to intranet daily	monthly
Customer (internal) perspective	interest rate to intranet thematic contents	no. of daily average accesses/logs to various internal web sites	monthly
Customer (internal) perspective	internal KM customer satisfaction	sending and % of replies (internal KM customer satisfaction questionnaire)	quarterly

Table 2 – Individual paired comparison – Selected KCF

INDIVIDUAL PAIRED COMPARISON - KNOWLEDGE CRITICAL FACTORS

ASSESSOR: EXPERT 5

DATE: 24 OCTOBER 2003

SELECTED KNOWLEDGE CRITICAL FACTORS (KCF)	KCF 1	KCF 2	KCF 3	KCF 4	KCF 5	KCF 6	KCF 7	KCF 8	TOTAL	INDIV. RANK
KCF 1: Time to market: speed to release products	X	0	2	1	1	2	1	1	8	3
KCF 2: Tools for measuring sw quality	2	X	0	0	1	2	1	2	8	3
KCF 3: Application effectiveness	0	2	X	2	2	2	2	1	11	1
KCF 4: Audience served by company knowledge base	1	2	0	X	2	1	1	2	9	2
KCF 5: Quantity of technical documentation produced (increment in %)	1	1	0	0	X	2	0	0	4	7
KCF 6: Overall active participation level to Company Forum	0	0	0	1	0	X	1	0	2	8
KCF 7: Qualitative (content-thematic) and overall (costs-economic-days) investment increase in specialistic, methodological and managerial knowledge	1	1	0	1	2	1	X	2	8	3
KCF 8: Interest rate to intranet thematic content	1	0	1	0	2	2	0	X	6	6

Votes for filling the sheet:
Reading from left to right:
If the indicator X (in row) **is more important** than the indicator Y (in column) then **vote 2**
If the indicator X (in row) **is less important** than the indicator Y (in column) then **vote 0**
If the indicator X (in row) **is equally important** than the indicator Y (in column) then **vote 1**

Table 3 – Collective/co-created paired comparison – Selected KCF

COLLECTIVE - CO-CREATED FINAL RANKING - KCF							
DATE: 24 OCTOBER 2003							
SELECTED KNOWLEDGE CRITICAL FACTORS (KCF)	EXPERT 1	EXPERT 2	EXPERT 3	EXPERT 4	EXPERT 5	TOTAL	COLLAB. RANK
KCF 1: Time to market: speed to release products	11	10	4	12	8	45	2
KCF 2: Tools for measuring sw quality	11	9	4	8	8	40	3
KCF 3: Application effectiveness	11	8	14	7	11	51	1
KCF 4: Audience served by company knowledge base	3	8	11	4	9	35	5
KCF 5: Quantity of technical documentation produced (increment in %)	1	5	11	4	4	25	7
KCF 6: Overall active participation level to Company Forum	4	5	2	4	2	17	8
KCF 7: Qualitative (content-thematic) and overall (costs-economic-days) investment increase in specialistic, methodological and managerial knowledge	10	5	5	8	8	36	4
KCF 8: Interest rate to intranet thematic content	5	6	5	9	6	31	6
	56	56	56	56	56	280	280
Note (*): Expert 5 voted as in Table 2					(*)		

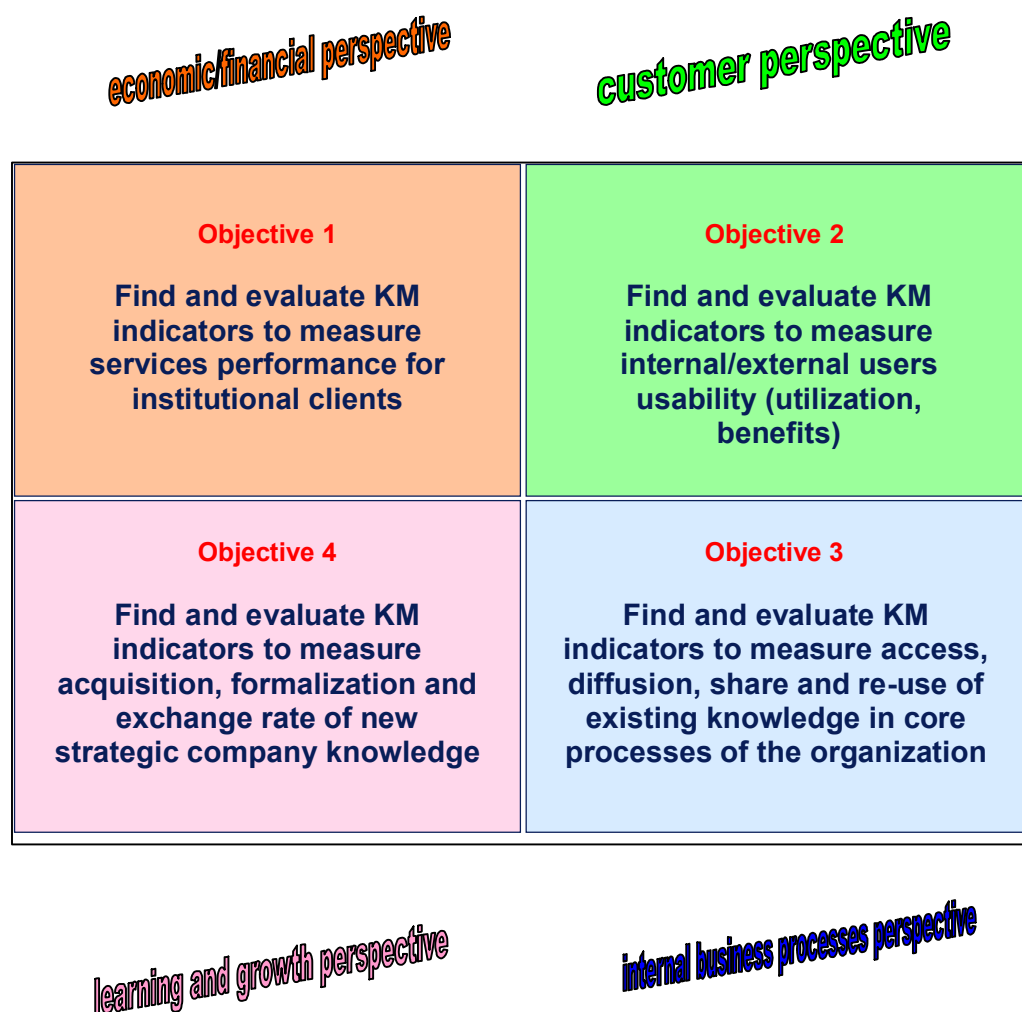**Table 4 – Collective/co-created paired comparison – key-criteria for measuring KCF**

COLLECTIVE - CO-CREATED FINAL RANKING - KEY-CRITERIA FOR MEASURING KCF							
DATE: 24 OCTOBER 2003							
Key-Criteria for measuring KCF	EXPERT 1	EXPERT 2	EXPERT 3	EXPERT 4	EXPERT 5	TOTAL	COLLAB. RANK
Criterion 1 = Measurement simplicity (calculation complexity)	14	0	8	10	7	39	5
Criterion 2 = Comprehension simplicity (clarity)	8	9	8	10	8	43	4
Criterion 3 = Social acceptability (at company level)	0	9	10	0	14	33	7
Criterion 4 = Measurableness over time (duration, permanence, stability)	6	14	9	10	7	46	2
Criterion 5 = Company strategicity (value added or value creation)	16	12	7	9	13	57	1
Criterion 6 = Comparability (with other diverse indicators)	9	4	10	8	7	38	6
Criterion 7 = General validity (improvements/worsening evaluation easiness)	3	10	10	5	2	30	8
Criterion 8 = Re-usability over time (as well for building up new indicators)	7	8	2	10	3	30	8
Criterion 9 = Easiness to collect information/data	9	6	8	10	11	44	3
	72	72	72	72	72	360	360

A **collaboration matrix** was developed parallelly to highlight and track relevant internal demand/offer processes, or the most important interactions between more critical knowledge intensive organizational units. This was done asking the heads of 12 relevant technical organizational units what knowledge was required and by which of the other 39 interested organizational units, producing in this way a simplified knowledge demand-supply organizational matrix. In other words, which technical offices were involved in internal specialised knowledge/consultancy demands/requests (customers) and offers (suppliers), based on work needs. This task was done first by paper (e.g. recording and filing of e-mail requests), and subsequently by electronic automation (Table 5).

Table 5 – Collaboration matrix (filled)

Collaboration Matrix

Technology & Know-How Area - Company organization

| Systems, Networks and Data Processing | Competencies Centers |

OU = Organizational Units (internal supply)

Column headers (Technology & Know-how Area OU, internal supply):
- Technical assistance - OU 1
- Technical hw-sw activation - OU 2
- Innovation and Architectures - OU 3
- Systems & Networks - OU 4
- Data processing-management - OU 5
- Logical security - OU 6
- Data warehouse - OU 7
- Quality and standard - OU 8
- Sw engineering - OU 9
- Telematics - OU 10
- Work flow and documentation - OU 11
- Web technologies- OU 12

Company Organizational Units (OU)
- Clients Area (internal demand) and
- Technology & Know-how Area (internal supply)

Clients Area - Company organization / **OU = Organization Units (internal demand)**

collaboration for external customers

Market 1
- Logistics and application activation - OU 13
- Sw application 1 - OU 14
- Operation planning - OU 15
- Sw application 2 - OU 16
- Sw application 3 - OU 17
- Sw application 4 - OU 18

Market 2
- Sw application 5 - OU 19
- Office application - OU 20
- Sw applications assistance - OU 21
- Sw application 6 - OU 22
- Sw application 7 - OU 23
- Logistics and application activation - OU 24
- Operation planning - OU 25
- Sw application 8 - OU 26
- Sw application 9 - OU 27

Market 3
- Sw applications assistance - OU 28
- Sw application 10 - OU 29
- Sw application 11 - OU 30
- Sw application 12 - OU 31
- Sw application 13 - OU 32
- Sw application 14 - OU 33
- Logistics and application activation - OU 34
- Sw application 15 - OU 35
- Operation planning - OU 36

Support
- Service center - OU 37
- New and special projects - OU 38
- External partnerships - OU 39

core internal technical collaboration

Technology & Know-How Area / **Systems, Netw....**
- Technical assistance - OU 1
- Technical hw-sw activation - OU 2
- Innovation and Architectures - OU 3
- Systems & Networks - OU 4
- Data processing-management - OU 5
- Logical security - OU 6

Competencies ....
- Data warehouse - OU 7
- Quality and standard - OU 8
- Sw engineering - OU 9
- Telematics - OU 10
- Work flow and documentation - OU 11
- Web technologies- OU 12

Legend: OU= Organizational Unit

Indicate, at crossroads, with a shading, Clients Area Organizational Units (OU) serving institutional clients, that require (internal demand) skills, competencies and specialistic know-how from Technology & Know-How Area Organizational Units (OU) (internal suppliers).
Follow also other subsequent detailed format for the specific issue-items required

Note:

The light green zone represents demand-supply processes/activities for institutional clients (i.e when Clients Area OU require specific competencies/skills from Technology & Know-How Area OU)
The light azure zone represents demand-supply processes/activities within Technology & Know-How Area OU

<u>Facilities and human interaction</u>: The second phase required 3 weeks and was divided in two meetings of 2 hours to share and select measurement scales and selection criteria for knowledge critical factors (implicit and explicit knowledge value), and four meetings of 3-4 hours to produce, using **paired comparison**, individual and collective rankings and priorities to fine tune and make a final selection of factors-indicators, which were later transformed into **knowledge value indicators (KVI)**. The 12 matrixes required for the **collaboration matrix**, working individually and asynchronously with sheets, required a week and produced a comprehensive collective map of internal knowledge demand-supply.

economic/financial perspective   customer perspective

Objective 1 Find and evaluate KM indicators to measure services performance for institutional clients	Objective 2 Find and evaluate KM indicators to measure internal/external users usability (utilization, benefits)
Objective 4 Find and evaluate KM indicators to measure acquisition, formalization and exchange rate of new strategic company knowledge	Objective 3 Find and evaluate KM indicators to measure access, diffusion, share and re-use of existing knowledge in core processes of the organization

learning and growth perspective   internal business processes perspective

Template 1 – Initial objectives of company BS-KM performance management system

Third phase (knowledge performance indicators setting)

As soon as the first two phases were completed the project rapidly addressed the identification of a more analytical series of indicators, which were opportunely linked to company production processes, and made it possible to measure periodically both experiences/knowledge exchange, and progressive know-how capitalization by means of data base feeding (Petrucciani, 1986) and other internal expert systems appropriately prepared (Petrucciani, 1988).

During this phase the project mainly followed a typical performance management methodology, oriented to identify **KPI (key performance indicators)** (Kaydos, 1999).

The client, with the support of a consultancy firm, specialized in this sector, built up some basic assumptions and target representation templates showing the logical framework of the final

phases of the project. The whole setting of the work put in place is described later in this paper, linking the 4 **balanced scorecard (BS)** perspectives, **knowledge management (KM)** and **performance management** assumptions and initial objectives (Template 1).

Starting from the whole design illustrated, the project team carried out an analytical knowledge mapping in following weeks which subsequently produced several analyses concerning:

- existing/necessary knowledge typologies/maps to sustain specific core corporate processes (e.g. institutional clients contract satisfaction, overall services satisfaction, etc.)

- existing/necessary tools/instruments/calculations to measure the increase in knowledge (e.g. ratio, data, surveys, statistics, trends, etc.)

- tentative initial standard targets, expressed as specific 'units of measurement' for each indicator, mapping them all on existing core corporate productive business processes and taking into account general internal procedures of KM governance processes.

Facilities and human interaction: The third phase envisaged a more intensive and different type of teamworking. Indeed in this part, which lasted about one month and a half, the main activities involved separate analyses of the impact of any knowledge factors-indicators from economic-financial perspectives for the company [extrinsic value]. In this part of the project the client utilized a specialized performance management consulting firm to support it in identifying and setting, through previous experience, more useful indicators for the specific situation. The project involved carrying out a simplified analysis of core company processes, which were represented in terms of the most significant **KPI - key performance indicators** to be measured, which were expressed, as can be seen, also from the 4 **balanced scorecard** perspectives and were later transformed in **knowledge value indicators (KVI).** This last part required 6 meetings of 4 hours, with intense collaborative interaction with project team members to select best knowledge value indicators (KVI) for the company and deploy them with different hypothesis for collection and calculation.

Fourth phase (knowledge value indicators tracking)

The fourth objective was to produce a practical dashboard to track change (e.g. improvements, increases, decreases, trends, etc.) in these knowledge value indicators (KVI) over time within organizational units and their constituents utilizing them.

The project team rationalized the overall results attained during previous weeks and months through the:

1. final identification of objectives for balanced scorecard-performance management systems for measuring company knowledge value;

2. analytical build up of architecture of company knowledge value system and scope. The structure of the architecture represents **three organizational observations/dimensions of company knowledge value system: overall company, core production business processes, tools and systems;**

3. model/framework for company knowledge value indicators, segmented in 3 layer levels: first level-dashboard (6 items), second level-synthetic (18 items) and third level-detailed (40 items).

4. final fine tuning of the executive dashboard and other two levels KVI, for their evaluation and monitoring over time;

5. setting of a data model (for subsequent recovery and calculation);

6. procedures for collecting and processing statistical data relative to each indicator;

7. setting and creation of calculation algorithms for each indicator.

The following pages outline the last steps of the project, namely, point 1., with an explanation of final objectives of the company performance knowledge value assumptions (Template 2), point 3., with an explanation of normalized and weighed sums (Template 3), and an example of a third level-detailed indicator for the **overall company** dimensions (Template 4), and, finally for point 4., the illustration of the executive dashboard overview (Template 5) and the complete illustration of one the 6 indicators of the executive dashboard, related to **tools and systems** (Template 6), including the cascading of first, second and third level indicators.

In the last Template 6, the numbers included in green and red boxes indicate complements to 100% (delta %) in the event of not achieving (red) or achieving/over-achieving (green) established targets, as result of calculation formula for each relative indicator.

Facilities and human interaction: The fourth phase required 3 weeks and 6 meetings to produce all necessary calculations for any specific KVI. Two meetings of 4 hours were held to produce and fine tune the executive dashboard for monitoring selected KVI and introduce an initial procedure to collect internal company data.

The knowledge value indicators measurement activities started in the company during winter 2004. During that period the project team helped to find initial standards to measure and compare over pre-established periodical timeframes. In this way any subsequent measurement served to monitor improvement/worsening in any KVI (whichever dimension) and to take necessary corrective actions, including the calculation formulae.

Subsequently, in spring 2004, the knowledge management project team produced a survey based on a perceptive questionnaire about the state of the art of KM in the company, in which the participants made clear points about the improvement of the KM measurement system designed.
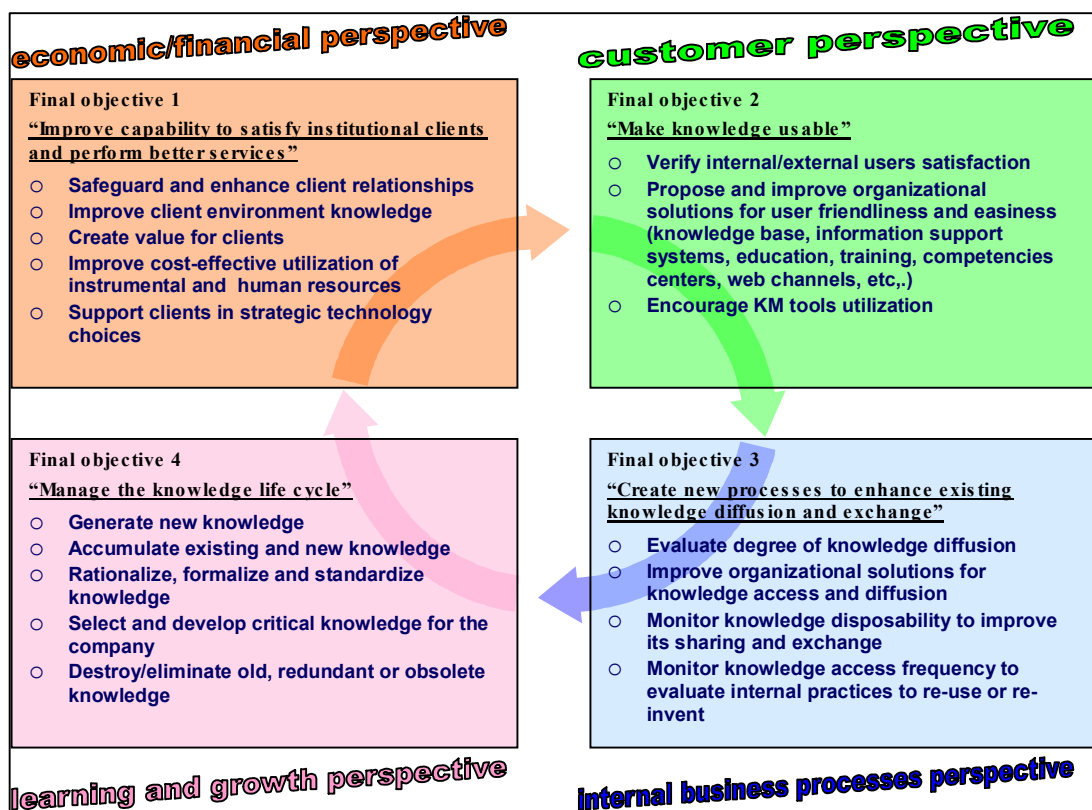
Template 2 – Final objectives of company BS-KM Performance Management system

For any of the 3 dimensions: 1) overall company, 2) core production business processes, 3) tools and instruments, the structure of knowledge value indicators (KVI) is articulated in 3 levels.

At the bottom there are detailed KVI, linked with operative facts.

At the middle level there are synthetic KVI, linked with managerial facts/actions, obtained as normalized weighed sum of KM detailed ones.
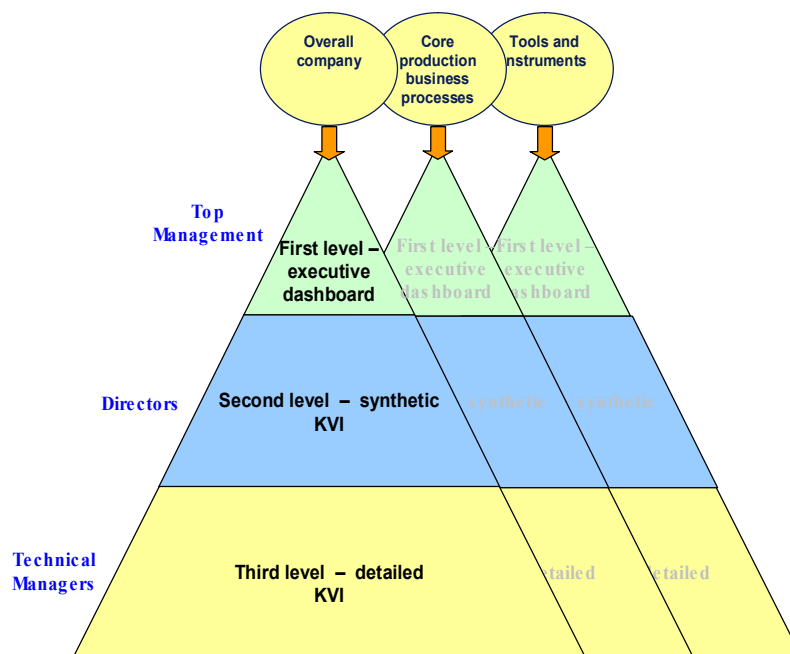
At the top level there is the executive dashboard, linked with company strategy and policies, obtained as normalized weighed sum of KVI synthetic ones.

The weight of each indicator (in %) express degree of importance, following and internal survey with company Directors, finalized to identify priorities for knowledge value.
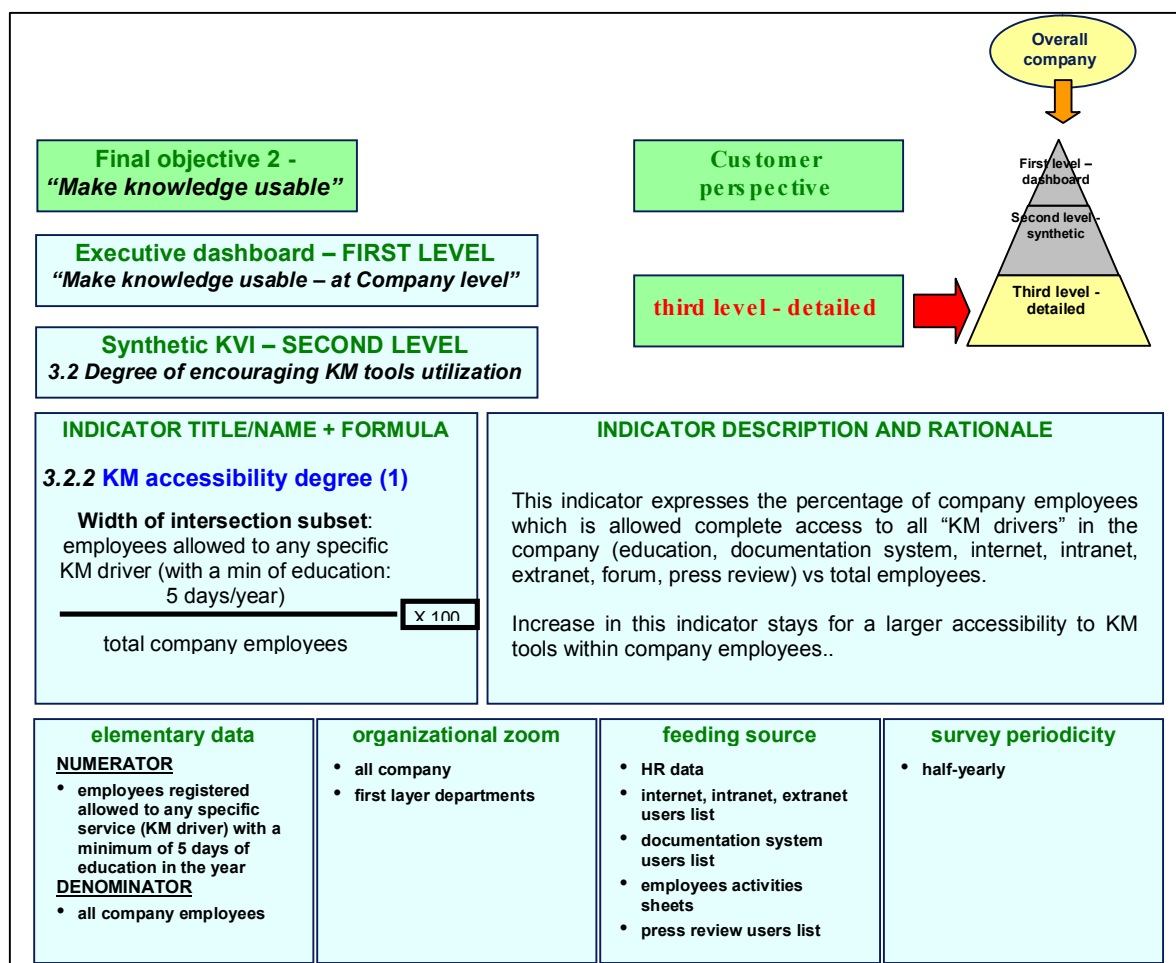
Overall were defined in the project:
o 6 indicators of first level (executive dashboard)
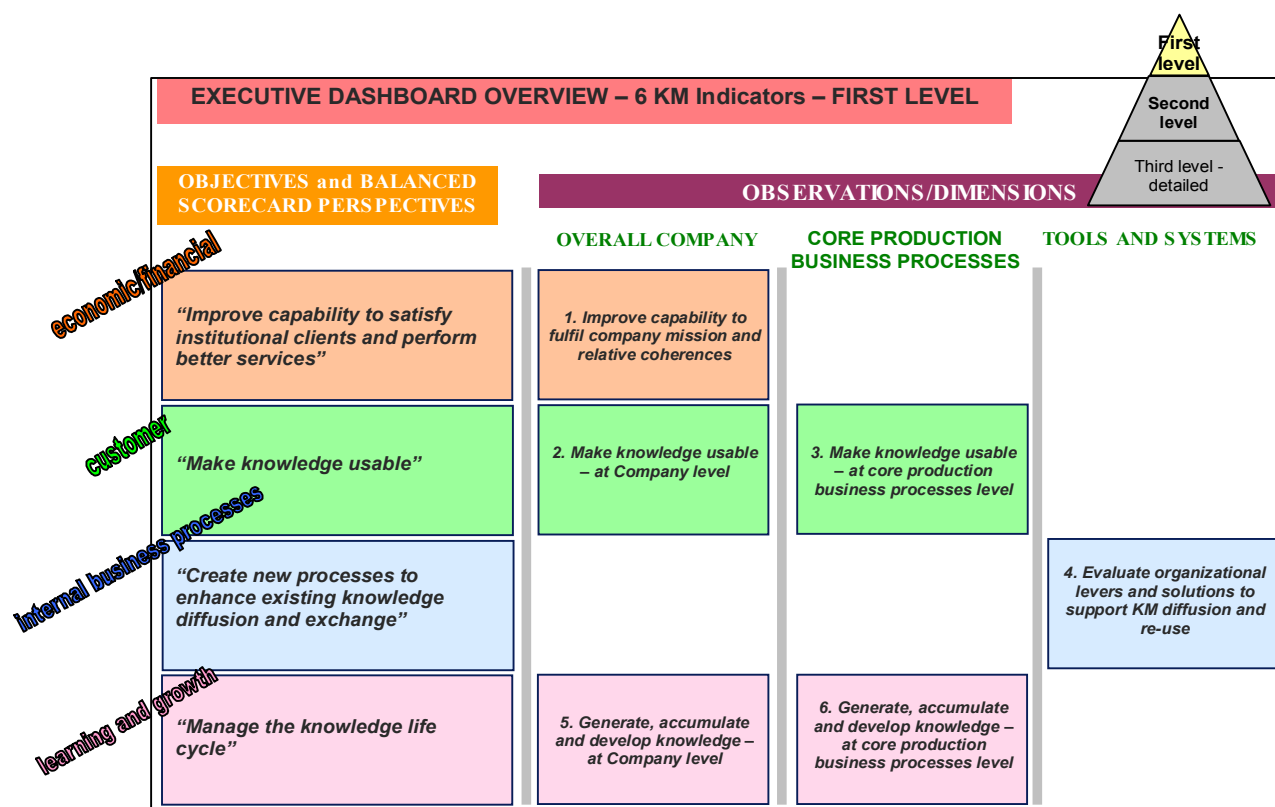o 18 KVI of second level (synthetic)
o 40 KVI of third level (detailed)

3 DIMENSIONS FOR KNOWLEDGE VALUE INDICATORS (KVI)

Template 3 – Model/framework of knowledge value indicators (KVI)

Final objective 2 - "Make knowledge usable"

Executive dashboard – FIRST LEVEL *"Make knowledge usable – at Company level"*

Synthetic KVI – SECOND LEVEL *3.2 Degree of encouraging KM tools utilization*

Customer perspective

third level - detailed

INDICATOR TITLE/NAME + FORMULA

3.2.2 **KM accessibility degree (1)**

Width of intersection subset: employees allowed to any specific KM driver (with a min of education: 5 days/year)

$$\frac{\text{Width of intersection subset: employees allowed to any specific KM driver (with a min of education: 5 days/year)}}{\text{total company employees}} \times 100$$

INDICATOR DESCRIPTION AND RATIONALE

This indicator expresses the percentage of company employees which is allowed complete access to all "KM drivers" in the company (education, documentation system, internet, intranet, extranet, forum, press review) vs total employees.

Increase in this indicator stays for a larger accessibility to KM tools within company employees..

elementary data	organizational zoom	feeding source	survey periodicity
NUMERATOR • employees registered allowed to any specific service (KM driver) with a minimum of 5 days of education in the year **DENOMINATOR** • all company employees	• all company • first layer departments	• HR data • internet, intranet, extranet users list • documentation system users list • employees activities sheets • press review users list	• half-yearly

Template 4 – Model/framework of knowledge value indicators (KVI)

Template 5 – Executive dashboard for company KVI (overview)

TOOLS AND SYSTEMS DIMENSION - KNOWLEDGE VALUE INDICATORS (KVI)

Final Objective 3

"Create new processes to enhance existing knowledge diffusion and exchange"

EXECUTIVE DASHBOARD - FIRST LEVEL

	code	KVI TITLE/NAME	ACHIEVED	TARGET	Δ
	4	Evaluate organizational levers and solutions to support KM diffusion and re-use	50%	50%	0%

SYNTHETIC KVI - SECOND LEVEL

WEIGHT %	code	KVI TITLE/NAME	ACHIEVED	TARGET	Δ	WEIGHT %	code	KVI TITLE/NAME	ACHIEVED	TARGET	Δ
25%	4.1	Diffusion of company documentation system	38%	39%	-1%	25%	4.3	Diffusion of internan education and training	75%	77%	-2%
25%	4.2	Diffusion of company intranet system	27%	24%	3%	25%	4.4	Diffusion of competencies centers company	63%	63%	0%

DETAILED KVI - THIRD LEVEL

WEIGHT %	code	KVI TITLE/NAME	ACHIEVED	TARGET	Δ	WEIGHT %	code	KVI TITLE/NAME	ACHIEVED	TARGET	Δ
15%	4.1.1	Public publishing of new documents (into documentation system)	20%	30%	-10%	40%	4.3.1	Average intense education/training (minimum of 5 days/year)	76%	80%	-4%
20%	4.1.2	Public publishing of new documents vs all documents (in documentation system)	75%	75%	0%	60%	4.3.2	Average education/training days/year for employee	75%	75%	0%
30%	4.1.3	Degree of utilization of company documentation system	40%	35%	5%	50%	4.4.1	Degree of utilization of company competencies centers organizational units by other units	40%	50%	-10%
25%	4.1.4	Average of documents downloaded by documentation system (same department)	10%	10%	0%	50%	4.4.2	Billing days by company competencies centers organizational units for institutional clients	85%	75%	10%
10%	4.1.5	Average of documents downloaded by documentation system (different department)	50%	60%	-10%						
55%	4.2.1	Degree of utilization of company intranet system	40%	35%	5%						
45%	4.2.2	Average pages downloaded from company intranet systems	10%	10%	0%						

Template 6 – Executive dashboard for company KVI (overview)

Results & Next Steps (The Follow-Up)

The project highlighted that the **KVI selected** are flexible, evolutionary and open to dynamic adaptation, following technological and sw application development implemented by the ICT company. The project cascading workpath adopted was, ex-ante, pre-determined and dynamically re-oriented, within the professional community involved, by means of periodical re-assessing of intermediate results.

The four phase joint protocol produced different and useful "within walls" awareness about:

- where primary and core knowledge is created, linked to products/services offered to institutional clients

- which relative value can be associated with different knowledge items

- ways of identifying specific indicators and critical criteria to measure knowledge items over time

- practical tools to discover any useful characteristic associated with knowledge items

- linking the performance management of the company to knowledge management issues and indicators

- establishing a set of knowledge performance indicators linked to core processes

- ways of and technologies for collecting data associated to these knowledge performance indicators

- building practical dashboard to monitor trends and tracking for these indicators

- useful follow-up initiatives to facilitate knowledge exchange/share on the job (education, culture, possible reward, etc.)

The type of results that can be achieved by these tools and methodologies include:

a) the degree of consensus about 'which critical knowledge is present in the environment or organization'

b) the level of soundness (either profit/non profit, social, individual, etc.) of knowledge measurement scale adopted

c) the level of depth in identifying knowledge value indicators (KVI) and their typologies (e.g. more economic-performance oriented [profit/non profit] vs more organizational-social oriented [individual/personal or collective])

d) the level of simplicity in designing the final dashboard of relevant knowledge value indicators (KVI) to monitor over time

e) the level of commitment in studying trends in knowledge exchange, creation and re-use, to produce better organizational or context effectiveness

Real Cases (As it has Happened)

Case 1 – large ICT public company

The overall protocol and specific workpath adopted in this paper were applied in a large ICT public company involved in supporting Government agencies to handle and manage a large mass of public data (sw production and technical/assistance services, including contact centers and web facilities). The primary mission of the company is to create and implement sw management applications mainly based on mainframes and on clusters of servers (more than one thousand) and PCs, with both central and local data processing and on line systems, in order to meet its own customers requests and requirements, as well as providing assistance and customer service (contact centers, web channels, knowledge base, etc.) to a large mass of users utilizing its applications. The company employs about 1600 people in various functions, and the technical staff are about 1200. The project, entitled "KM Indicators", started during summer 2003, and was launched and promoted by the Managing Director to investigate and better understand: a) how much, its own professionals, "know", "know how to do things" and "how much knowledge and how many solutions are shared" to facilitate either productive internal efficiency and capitalization of experiences acquired on the field, and b) how to set and orientate internal collaboration themes on exchange, feeding and diffusion of internal know-how, both technical and application-oriented, to foster internal growth and support institutional clients.

Shortly before this project, a preliminary survey was carried out, based on interviews and a questionnaire, commissioned by top management, aimed at investigating the state-of-the-art of KM in the company, and assessing the diffusion of already implemented internal tools (i.e, intranet, technical websites, forums, experts map, competencies centres, etc.) to enable the dissemination and circulation of specialised company know-how. The processing of data and the final report with highlights lasted one month and a half.

Activities begun immediately after to determine what the company needed for the **start-up of a KVI study**, aimed at identifying ways of measuring and evaluating the company's capability of:

- identifying the critical knowledge present in its tech population, with reference to some core specialised sectors (application sw, system and telecommunications sw, data base management, applications and technical assistance for customers, etc.)

- rendering explicit the critical tacit knowledge present within company professionals

- facilitating and optimizing internal collaboration and knowledge exchange, feeding and diffusion about technical and application-oriented matters between various professionals, mainly to foster internal growth and services to institutional clients

- producing a more efficient knowledge asset governance process, in terms of capitalization of acquired experiences and relative solutions engineering

The scope of the company project, driven forward during autumn 2003–winter 2004, also had the aim of improving the efficiency of existing knowledge governance processes (development, formalisation, sharing, re-use) to capitalize experiences acquired on the field with clients and users (Petrucciani, 2005).

A detailed workpath was put in place to identify KVI and fine tune subsequent measurement instruments (Template 7), which included:

1. an internal survey to identify critical success factors (CSF) that have direct impact on services/performances provided by the company to its customers, subsequently transformed in indicators of company knowledge value

2. the translation and attribution of these factors to 4 Balanced Scorecard perspectives (economic-financial, customer, internal business processes, learning and growth)

3. an internal survey to identify key-criteria for collecting and measuring over time knowledge indicators-factors

4. the ranking of the relative importance of knowledge indicators-factors

5. the ranking of relative importance of key-criteria, to measure them over time

6. the creation of attributes/characteristics for every knowledge indicator-factor linked to relevant organizational units knowledge demand-supply

7. the setting up of map: company business processes-phases of creation, formalization, sharing and re-use of knowledge created within the company

8. the recognition of company key-knowledge[ables] (or core competencies) linked to each business process

9. the structured identification of analytical knowledge performance indicators linked on one hand to typical company knowledge associated with each business process, and, on the other to relative objectives of same processes, to measure their value

10. the creation of top management dashboard related to selected company knowledge assets, for monitoring and assessing knowledge indicators periodically, as in a stock exchange oscillation, mainly to present the company's value and image in an innovative way.
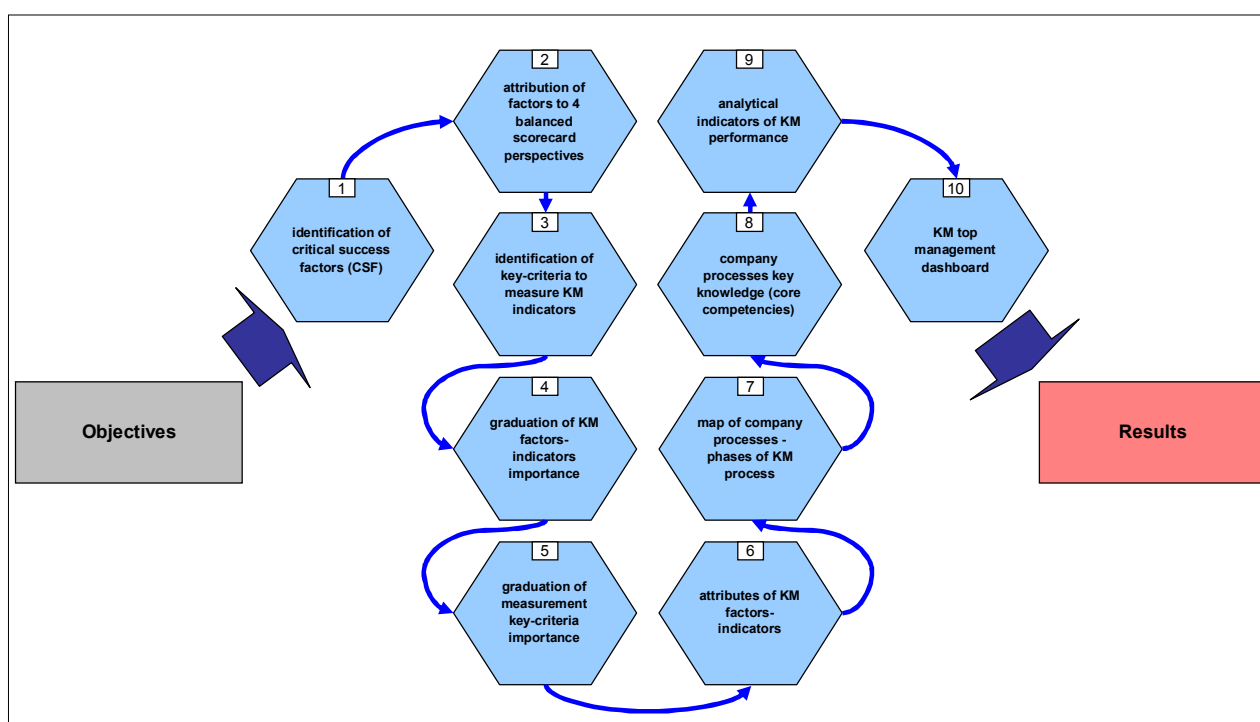
Template 7 – Workpath for ICT client case

Other cases – independent cascaded workpaths or the separate use of tools and techniques

You can work with separate tools and techniques to produce a slighter or deeper understanding of knowledge value in a company or organization. In this way you can choose to follow different workpaths, also heuristically, depending on specific company priorities and this will work rapidly or reflectively for the task. In these cases you will use an '**open approach**' with different tools for different aims and you can re-arrange subsequent ones dinamically, or stop on the way, depending on the points or milestones you want to achieve or you are satisfied with.
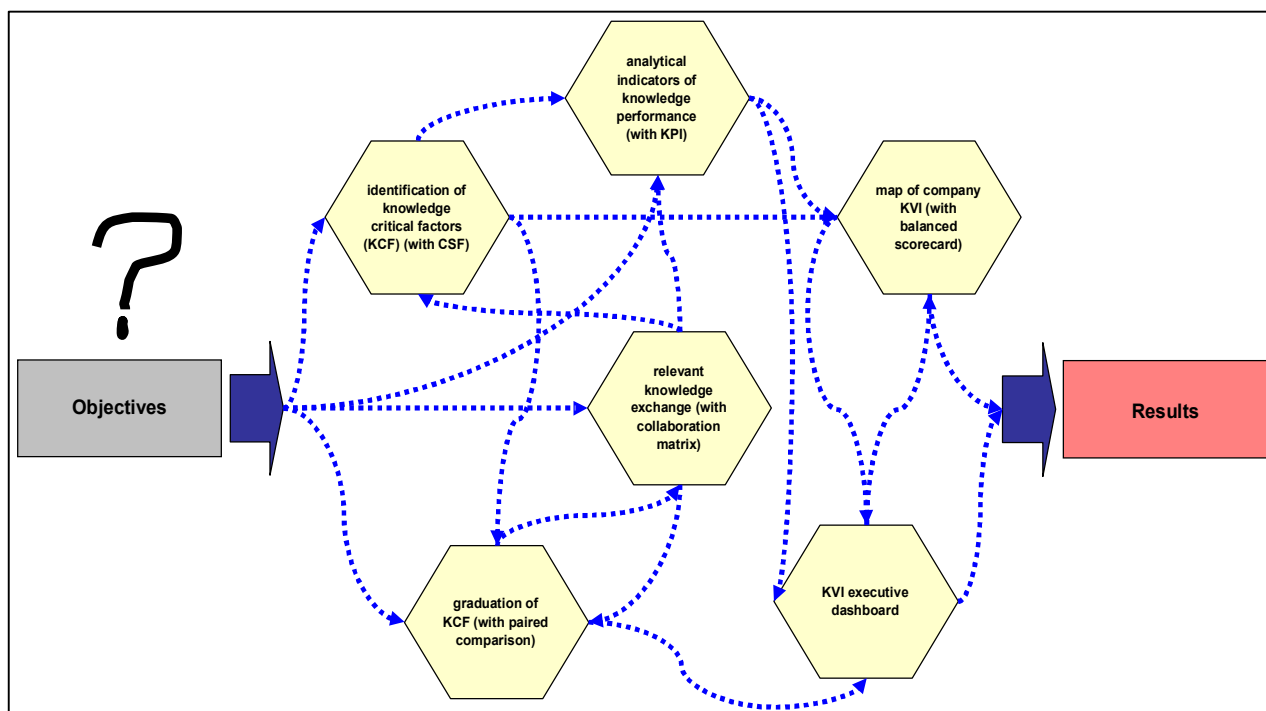
Template 8 – Independent cascaded workpaths

Tips & Tricks (To-Do)

Some practical tips are outlined that may be used to maintain the energy of the group.

☑ ensure strong commitment to achieve objectives related to giving significant added value in sharing company knowledge assets (sourcing, feeding, creating)

☑ establish a clear ex-ante project planning, specifying that any subsequent adjustments will be shared and co-created in progress by team members (democratic approach)

☑ fix precise deadlines to present results of milestones and track cumulative progress of the project, fine tuning subsequently the timeframes vs final delivery (forward-backward approach), by team members or leader

☑ enable, facilitate and foster individual point of views about the problem/phase, mainly related to personal work experiences and competencies, as a way of contributing to any innovative idea regarding company knowledge use/exploitation (dialogues/interactions)

☑ create a personal and team tension about the results of the knowledge project (e.g. reward/premium/quality policies, return on company value or company image, reputation of product/process brand, new organizational opportunities/roles, etc.)

Potholes (Not-to-Do)

- ☒ avoid any excessive personal leadership in navigating the project, it should remain the authors/members property till the end (except for top management)

- ☒ do not use fixed ways of exchanging info or tools (e.g. e-mail or knowledge repository), but on the contrary promote any large synchronous (e.g. meeting, expert panels, front-office collective interviews, etc.) or asynchronous contributions (e.g. via e-mail, wikis or other electronic tools)

Acknowledgements

I would like to thank all directors, managers and senior employees, working in the large public ICT company (that has chosen to remain anonymous) that provided all necessary cooperation to complete successfully the case-initiative presented in this paper. Without their contribution most of the personalization techniques and tools utilized could not have been completely analyzed, explored and fine tuned for this special application. On the contrary, most of the paired comparison and collaboration matrix techniques were extensively utilized by a number of clients for specific consensus building and co-creation applications on various matters (competencies, values rankings, and organizational roles).

Resources (References)

David. H.A. (1988), *The method of paired comparisons*, second edition, Chapman and Hall, London, 1988

John F. Rockart (1979), *Chief Executives define their own data need*, Harvard Business Review, March-April 1979

Karl-Erik Sveiby (2006), *Soft assets; measuring the immeasurable (chapter 10, pgg. 91-105),* in *Next Generation Knowledge Management,* by Jerry Ash, Association of knowledgework - AOL, Ark Group, London, 2006

Kimir Dalkir (2005), *Knowledge Management in theory and practice*, Elsevier, 2005

Michael Armstrong and Helen Murlis (1991), *Reward Management – A handbook or remuneration strategy & practice*, Kogan Page, London (second edition), pgg. 459-463 (appendix B), 1988

Paolo Petrucciani (1986), *Produttivita', management e Apprendimento- 3ᵃ parte: nuove frontiere nell'apprendimento,* Impresa e Societa', Cedis Editrice, 15 april 1986, Anno XVI, n.7, pagg.6-19

Paolo Petrucciani (1988), *L'impatto organizzativo dei sistemi a supporto delle decisioni,* Informatica e Direzione aziendale, Cedis Editrice, june 1988, Anno 3, n.6, pagg.8-21

Paolo Petrucciani (1990), *Verso il duemila: incertezze e valori,* Tempo economico-Rivista di management, F.lli Pini Editori Srl, july-august 1990, Anno XXVII, n.299-300, pagg.54-62

Paolo Petrucciani (2005), *Metodologie per l'individuazione di indicatori di misurazione della conoscenza in azienda*, 10° Knowledge Management Forum", organized by Jekpot srl, Siena 24-25 november 2005

Paolo Petrucciani (2006), *Methodologies for Identifying Knowledge Value Measurement Indicators in a Company, Knowledge Board*, http://www.knowledgeboard.com/lib/3443 (date published, 21 august 2006)

Robert S.Kaplan, David P. Norton (1992), *The Balanced Scorecard – Measures that drive performances*, Harvard Business Review, January-February 1992

Robert S.Kaplan, David P. Norton (1996), *The Balanced Scorecard – translating strategy into action*, Harvard Business School Press, Boston, Massachusetts, 1996

Will Kaydos (1999), *Operational Performance Measurement*, St. Lucie Press, New York, USA, 1999

Author Biography

Paolo Petrucciani, 55, has worked in the management consultancy sector since 1988. His most recent projects concern knowledge management and change management applications. He has run his own management consultancy firm, Epistema, working mainly for large private and public companies since 2000. He obtained his first certification as CMC (Certified Management Consultants) from APCO in 1994, the Italian professional body of ICMCI (The International Council of Management Consulting Institutes). After taking a degree in Mathematics - Rome (1975), and specialising in behavioural cybernetics in UK under the supervision of Prof. Gordon Pask (Brunel University, Open University) (Richmond, 1977), he worked for 11 years in the ENI group, and later in an engineering company, as information technologist, sw analyst and system engineer (decision support systems and modeling, techniques and tools), and afterwards in a large data processing company (managerial education in ICT and innovative projects on distance learning and computer based training). He joined HayGoup in Italy in December 1988, where he climbed the professional ladder moving from consultant to senior consultant, practice leader and finally senior director, contributing to all HR and organizational issues (organization analysis and evaluation, compensation and development systems, culture, innovative projects, etc.)