

# Methodologies for identifying knowledge value measurement indicators in a company

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## Summary

This paper exposes a working methodology utilized in a real client case (Petrucciani, 2005), and subsequently generalizable, to identify a 'knowledge management value' measurement system in a company.

At the root of study-project was the top management need to measure and evaluate company capability: a) to identify critical knowledge present in its population, with reference to its specialistic service sector, b) to render explicit some tacit knowledge present in its tech professionals, and c) to facilitate and optimize knowledge exchange about systems and sw applications matters/issues, between various professionals, prevalently for company's institutional clients benefit, from the point of view of: a) 'efficiency of existing knowledge asset governance processes', b) 'capitalization of acquired experiences' and c) 'solutions engineering'.

## 1.1 Purpose of the project and the client case

The project, named "Knowledge Management Indicators", started in the client "X" during summer 2003, pushed by the Managing Director to investigate and better comprehend: 1) how much, its own professionals, "know", "know how to do" and "how many knowledge and solutions share" to facilitate either productive internal efficiency and capitalization of experiences acquired on the field, and 2) how to set and orientate internal collaboration themes on exchange, feeding and diffusion of internal know-how, both technical and application-oriented, to advantage internal growth and service to institutional clients.

Client "X" is a large public information technology company that creates and implements sw management applications mainly based on mainframes and on clusters of servers (more than one thousand) and PC, with either central and local-territorial data processing and telematics, following its own customers requests and requirements, second scope of the company is 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, technical staff are about 1200 professional resources and individuals directly involved in the project team were roughly 15-20.

## 1.2 Identification of knowledge management value according to Balanced Scorecard methodology

First activities of the project were addressed to an internal survey to identify which should be considered **critical success factors (CSF)** (Rockart, 1979) with direct impact on company services towards core clients, having in mind, as “principal driver for investigation”, both company performance profile and internal/external know-how circulation.

The methodology utilized to identify these critical factors, subsequently transformed in KM indicators, is the Balanced Scorecard (BS) (Kaplan and Norton, 1996).

The objective of this *first phase (recognition)* of the project was to select rapidly some factors-indicators able to measure “knowledge value” for the company, both under economic, professional and specialistic profile.

As illustrative but not exhaustive note, some of principal **critical factors (CF)** identified in this part of the survey (overall the project team identified about 20 critical factors), also starting from quality system indicators of the company (certification ISO UNI EN 9001: 2002, productive processes) and following 4 Balanced Scorecard perspectives logic, were:

- **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 stays for new or more efficient technology solution 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 to specialistic forum (under

intranet); amount of investments in specific education/training seminars finalized to increase specialistic and technologies-methodologies knowledge.

A preliminary measurement system and measurement periodicity was then identified for each factor-indicator.

### **1.3 From critical factors recognition to KM indicators, sharing their relative importance and key-criteria for subsequent measurement in time**

In the *second phase (general setting)* the project team transformed the identified CSF in KM indicators and produced a system to validate, evaluate and graduate (rank) selected factors-indicators by means of 'democratic sharing mechanisms', following 'paired comparison' methodology (David, 1988) that permits to vote relative internal importance between them.

Finded some key-criteria that should have permitted to facilitate the task to collect and measure in time these indicators, with the same 'paired comparison' methodology, the project team produced evaluations and graduations.

Below are shown the two final templates (Table 1, Table 2) that report votes-graduations realized by five client internal experts.

Parallel, as auxiliary operative tool, the project team build up a "collaboration matrix" to track internal demand/offer process, in other words, whose technical offices were involved in internal specialistic knowledge/consultancies requests (customers) and offers (suppliers), based on work needs. This task was done first at cartaceous level (e.g. recording and filing of e-mail requests), subsequently with electronic automation.

### **1.4 From KM factors-indicators importance to creation of attributes/characteristics linked to their value**

To complete *second phase (general setting)* the project team realized a special format to clarify more precisely motivation of the choice of one KM factor-indicators vs others and principal benefits derived by its measurement; see example below in succession (Table 3).

These activity was completed for six KM factors-indicators, of the eight selected, considered particularly critical for their company value and impact.

**Table 1**  
**Final Ranking - KM Selected Factors**

<i>FINAL RANKING - KM FACTORS - COLLECTIVE - NON WEIGHED</i>							
<i>DATE: 24 OCTOBER 2003</i>							
<b>SELECTED KM FACTORS</b>	<b>E X P E R T</b>	<b>E X P E R T</b>	<b>E X P E R T</b>	<b>E X P E R T</b>	<b>E X P E R T</b>	<b>TOTAL</b>	<b>RANK</b>
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>		
INDICATOR 1: Time to market: speed to release products	11	10	4	12	8	45	2
INDICATOR 2: Tools for measuring sw quality	11	9	4	8	8	40	3
INDICATOR 3: Application effectiveness	11	8	14	7	11	51	1
INDICATOR 4: Audience served by company knowledge base	3	8	11	4	9	35	5
INDICATOR 5: Quantity of technical documentation produced (increment in %)	1	5	11	4	4	25	7
INDICATOR 6: Overall active participation level to Company Forum	4	5	2	4	2	17	8
INDICATOR 7: Qualitative (content-thematic) and overall (costs-economic-days) investment increase in specialistic, methodological and managerial knowledge	10	5	5	8	8	36	4
INDICATOR 8: Interest rate to intranet thematic content	5	6	5	9	6	31	6
	56	56	56	56	56	280	280

**Table 2**  
**Final Ranking - Key-Criteria for measuring KM Indicators**

<i>FINAL RANKING - KEY-CRITERIA FOR MEASURING KM INDICATORS - COLLECTIVE - NON WEIGHED</i>							
<i>DATE: 24 OCTOBER 2003</i>							
	<b>E X P E R T</b>	<b>E X P E R T</b>	<b>E X P E R T</b>	<b>E X P E R T</b>	<b>E X P E R T</b>		
<b>Key-Criteria for measuring KM Indicators</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>TOTAL</b>	<b>RANK</b>
<b>Criterion 1 = Measurement simplicity (calculation complexity)</b>	14	0	8	10	7	39	5
<b>Criterion 2 = Understanding simplicity (clarity)</b>	8	9	8	10	8	43	4
<b>Criterion 3 = Social acceptability (at company level)</b>	0	9	10	0	14	33	7
<b>Criterion 4 = Measurableness in time (duration, permanence, stability)</b>	6	14	9	10	7	46	2
<b>Criterion 5 = Company strategicity (value added or value creation)</b>	16	12	7	9	13	57	1
<b>Criterion 6 = Comparability (with other diverse indicators)</b>	9	4	10	8	7	38	6
<b>Criterion 7 = General validity (improvements/worsening evaluation easiness)</b>	3	10	10	5	2	30	8
<b>Criterion 8 = Re-usability in time (as well for building up new indicators)</b>	7	8	2	10	3	30	8
<b>Criterion 9 = Easiness to collect information/data</b>	9	6	8	10	11	44	3
	72	72	72	72	72	360	360

**Table 3**  
**Special Format - Attributes/Characteristics of KM Indicators**

<b>Balanced Scorecard Perspectives</b>			
<b>Perspective significance</b>			
<i>Economic/Financial Perspective</i>			
how should we satisfy our shareholders ?			
<i>Customer Perspective</i>			
how should we satisfy our customers ?			
<i>Internal Business Processes Perspective</i>			
how should we improve our internal efficiency ?			
<i>Learning and Growth Perspective</i>			
how should we sustain our ability to develop/innovate ?			
<b>ATTRIBUTES/CHARACTERISTICS OF KM INDICATORS</b>			
<i>Indicator title/name</i>	<i>Belonging to which company process ?</i>	<i>Measurement unit (4)</i>	<i>What is the scope of the indicator ?</i>
Applications effectiveness	Sw applications running	no. of information requests inbound to Call Center (by customers)/running function points	to verify sw quality production; to quantify Call Center charge for specific applications
<i>Indicator meaning</i>	<i>Actors/Managers (1)</i>	<i>Measurement periodicity (5)</i>	<i>Indicator choice motivation</i>
	xx, yy, zz	monthly	service quality general indicator
<i>Indicator definition</i>	<i>Data owner (Organization Unit) (2)</i>	<i>Measurement survey/typology modality (6)</i>	<i>Causes and effects linked to indicator</i>
Successful application use by final users (effectiveness impact)	various Organizational Units	manual and automatic (electronic)	level of defectiveness of sw applications, sw design architecture, programs complexity, sw productivity, etc.
<i>Technical notes</i>	<i>Availability (3)</i>	<i>Measurement tools (7)</i>	<i>Company value</i>
	short term (S)	Call Center inbound data related to specific applications; relative users, function points, etc.	High; useful to measure sw production processes
<b>Legend</b>			
(1) - indicate surnames of incumbents, process owners or data owners			
(2) - indicate Organizational Units managing interested company process and/or have/own necessary data			
(3) - I = immediate availability , S = short term availability (within 3 months), M = medium term availability (within 6 months), L = long term availability (within 12 months)			
(4) - may be composed by a single value (numerator), by a ratio (numerator/denominator) and/or by other elementary formulae			
(5) - daily, bi-weekly, weekly, bimonthly, monthly, bimonthly, quarterly, half-yearly, yearly			
(6) - MA = manual; AU = automatic; indicate if cartaceous, electronic or other type			
(7) - indicate which instrumentations or tools are necessary for calculation			



## 1.5 A performance management system for knowledge management

Finished first two phases (recognition and general setting), the project rapidly addressed individuation of more analytical series of indicators, which, opportunely linked to company productive processes, should have permitted to measure periodically either experiences and knowledge exchange, and progressive know-how capitalization by means of data base feeding (Petrucciani, 1986) and other internal expert systems appropriately prepared (Petrucciani, 1988).

In this **third phase (specific performance setting)** the project followed mainly 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, build up some basic assumptions and target representation templates showing logic framework of final phases of the project.

The whole setting of work realized is presented in succession, linking the 4 Balanced Scorecard (BS) Perspectives, Performance Management (PM) and Knowledge Management (KM) assumptions and initial objectives (Templates 1 and 2).

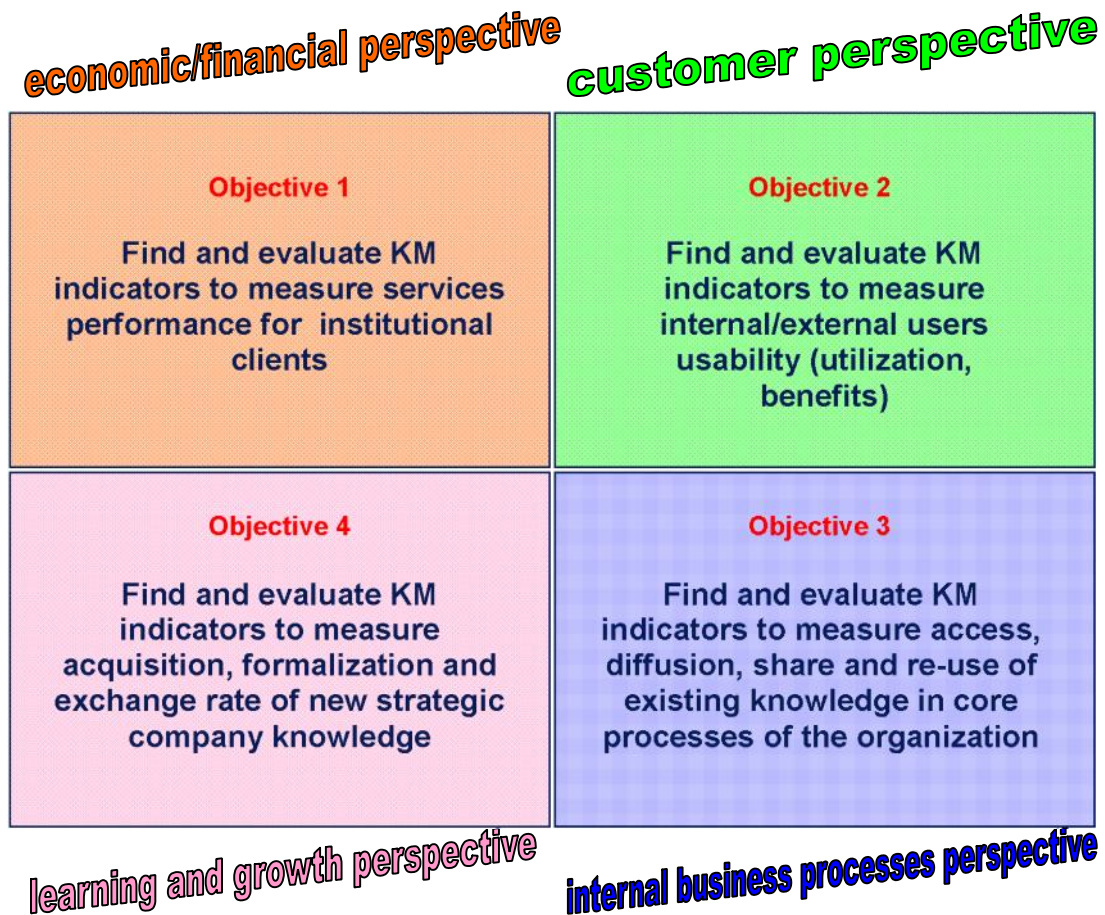
### Template 1

#### BS-PM-KM basic assumptions



## Template 2

### Initial objectives of company BS-KM Performance Management system



Starting from illustrated whole design, the project team carried out in the following weeks the **fourth phase (analytical knowledge mapping)**, producing subsequently, several analyses: a) existing/necessary knowledge typologies/maps to sustain specific company core processes (e.g. institutional clients contract satisfaction, overall services satisfaction, etc.), b) existing/necessary tools/instruments/calculations to measure knowledge increase (e.g. ratio, data, surveys, statistics, trends, etc.), c) tentative initial standard targets, expressed as specific 'unit of measurement' for each KM indicator, mapping them all on existing company core productive business processes and taking into account the exposed general phases of KM governance processes.

An illustration of utilized methodology it is shown below, where the macro-matrix synthesizes in depth analyses realized by the project team (Template 3). Every box of the matrix was initially fulfilled - as for point a) exposes above - from 1 to 4 items (for a total of about 50 items), that represented first idea of final KM indicators.



### Template 3

#### KM processes – Core company business processes Macro-matrix

		Phases of knowledge management processes			
		acquire/develop	formalize	diffuse-share	re-use
Core company business processes	Technical, normative and organizational consultancy	knowledge typologies/maps			
	Sw applications and relative maintenance				
	Systems and data processing management	knowledge measurement tools			
	Technical and application assistance				
	Technological and systems support	standard targets (KM indicators)			
	Training and education				

#### 1.6 Knowledge mapping linked to core company business processes: core knowledge

During the same *fourth phase (analytical knowledge mapping)*, the project team realized a complete reconnaissance of principal core competencies associated to company business processes, starting from existing knowledge classification included in company skill inventory and other techniques (McGraw, Harbison-Briggs, 1989).

In this occasion the project team produced a specific format to allow all managers of technical Organizational Units (architect, project, realization, data processing management, systems and networks, assistance, education and training) to highlight those they considered the **'key-knowledge necessary to possess for a specific business process'**, then, in this way, associable to professionals of that specific Organizational Unit (Phillips, Stone, Phillips, 2001).

In the next table (Table 4) it is shown the provided format for "Systems and data processing management" business process – segment/profession: "Central and territorial-peripheral applications processing".

**Table 4**

**Format - Core competencies in a company business process**

<b>Process:</b> Systems and data processing management	<b>Profession:</b> Central and territorial-peripheral applications processing
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**(Core Competencies)  
KEY BENCHMARKS**

Selected knowledge (from Skill Inventory)	Required level (knowledge requirements)				
	1	2	3	4	Notes
1 Processing Mainframe					
2 Processing PC					
3 Processor operation systems – MVS/OS/390					
4 Processor operation systems - Windows XP					
5 Access methods – VSAM					
6 DBMS relational – DB2					
7 OLTP TSO/ISPF					
8 OLTP CICS					
9 JCL language					Previously not required in skill inventory professional sheet competence
10 SAS language					
11 Support tool - Endeavor Datawarehouse support tools (Warehouse Manager)					
12 Data Management					Previously not required in skill inventory professional sheet competence

**Compilation notes:**

Select a maximum of 10-12 competencies for specific profession, extracting them by specific segment of company skill inventory (“**Technology knowledge, Processes and methods, Professional experience, Foreign languages, Institutional clients organizational/technological environment knowledge, Application typologies knowledge**”), adapting them to own organizational-professional environment and specific business process.

**Concentrate on fundamental and strategic competencies to fulfil effectively profession indicated, or those competencies that, if not present, may cause a possible drop in job performance, under know-how/expertise profile.**

## 1.7 Executive dashboard, second and third level company KM indicators

In the **fifth and last phase of the project (KM indicators systematization)** the project team rationalized overall obtained results during previous weeks and months:

- a) final identification of objectives for Balanced Scorecard-Performance Management system for measuring company KM value;
- b) analytical building up of architecture of company KM and scope. The structure of the architecture represents the **three organizational observations/dimensions of company KM: Overall company, Core production business processes, Tools and systems;**
- c) model/framework for company KM indicators, segmented in 3 layers levels: first level-dashboard (6 items), second level-synthetic (18 items) and third level-detailed (40 items).
- d) final fine tuning of the executive dashboard and other levels KM indicators, for their evaluation and monitoring in time;
- e) setting of data model (for subsequent recovering and calculation);
- f) procedures for collecting and processing statistical data relative to each KM indicator;
- g) setting and creation of calculation algorithms for each KM indicator.

In the following pages are presented, respectively, point a) (Template 4), point b) with explanation of the KM architecture (Template 5), point c) with explanation of normalized and weighed sums (Template 6), and an example of a third level-detailed KM indicator for **Overall company** dimension (Template 7), and, finally, for point d), the illustration of the executive dashboard overview (Template 8) and the complete showing of one the 6 KM indicators of the executive dashboard, related to **Tools and systems** dimension (Template 9), including the cascading of first, second and third level KM indicators.

In the last Template 9, the numbers included in green and red boxes express complements to 100% (delta %) in case of not achieving (red) or achieving/over-achieving (green) vs established targets, as result of calculation formula for each relative KM indicator.

## Template 4

### Final objectives of company BS-KM Performance Management system

#### economic/financial perspective

##### Final objective 1

“Improve capability to satisfy institutional clients and perform better services”

- Safeguard and enhance client relationships
- Improve client environment knowledge
- Create value for clients
- Improve cost-effective utilization of instrumental and human resources
- Support clients in strategic technology choices

#### customer perspective

##### Final objective 2

“Make knowledge usable”

- Verify internal/external users satisfaction
- Propose and improve organizational solutions for user friendliness and easiness (knowledge base, information support systems, education, training, competencies centers, web channels, etc.,)
- Encourage KM tools utilization

##### Final objective 4

“Manage the knowledge life cycle”

- Generate new knowledge
- Accumulate existing and new knowledge
- Rationalize, formalize and standardize knowledge
- Select and develop critical knowledge for the company
- Destroy/eliminate old, redundant or obsolete knowledge

##### Final objective 3

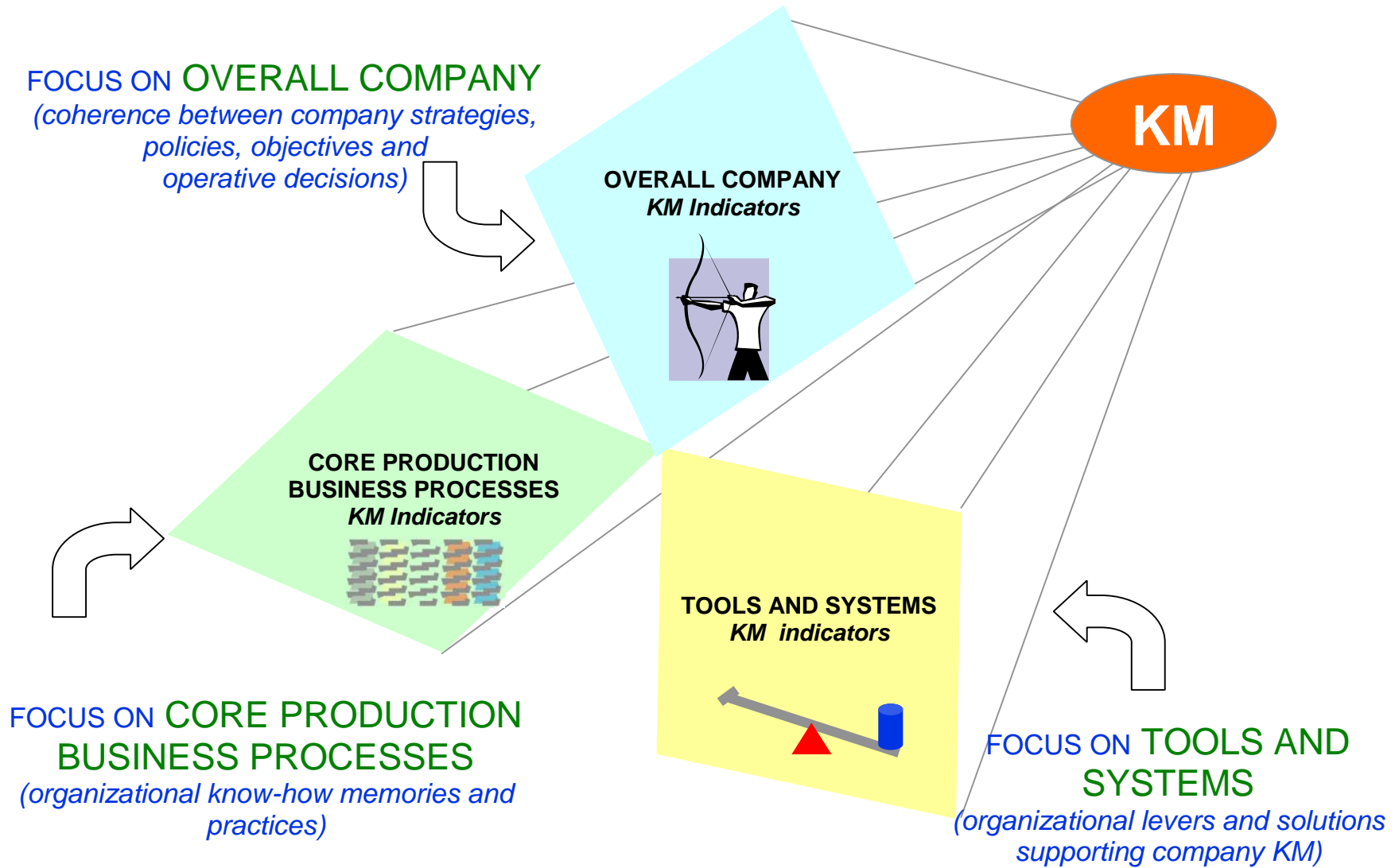
“Create new processes to enhance existing knowledge diffusion and exchange”

- Evaluate degree of knowledge diffusion
- Improve organizational solutions for knowledge access and diffusion
- Monitor knowledge disposability to improve its sharing and exchange
- Monitor knowledge access frequency to evaluate internal practices to re-use or re-invent

#### learning and growth perspective

#### internal business processes perspective

**Template 5**  
**Architecture and dimensions of KM indicators**



## Template 6

### Model/framework of KM indicators

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

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

At the middle level there are synthetic KM indicators, linked with managerial facts/actions, obtained as normalized weighed sum of KM detailed ones.

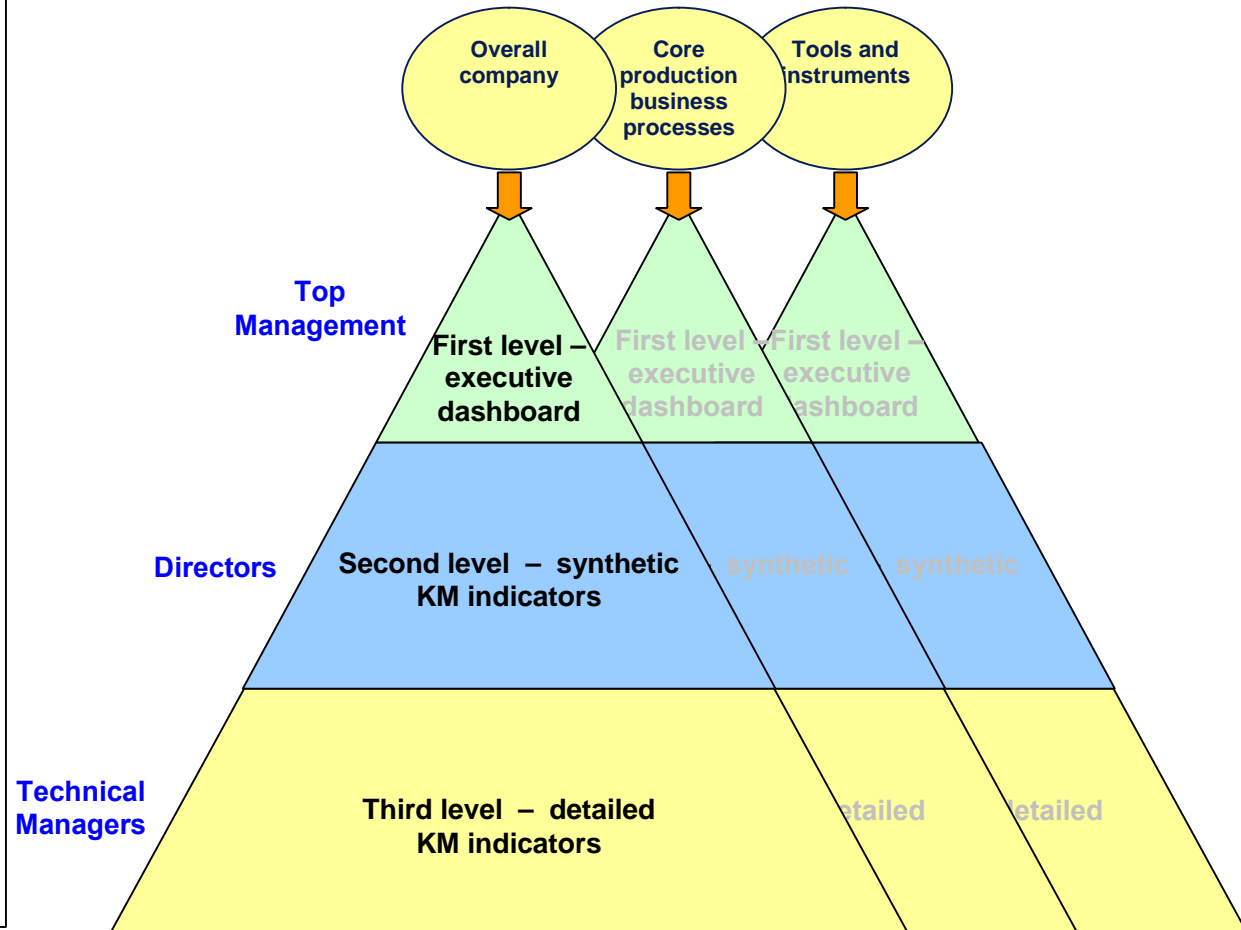
At the top level there is the executive dashboard, linked with company strategy and policies, obtained as normalized weighed sum of KM synthetic ones.

The weight of each KM indicator (in %) express degree of importance, following and internal survey with company Directors, finalized to identify priorities for KM value.

Overall were defined in the project:

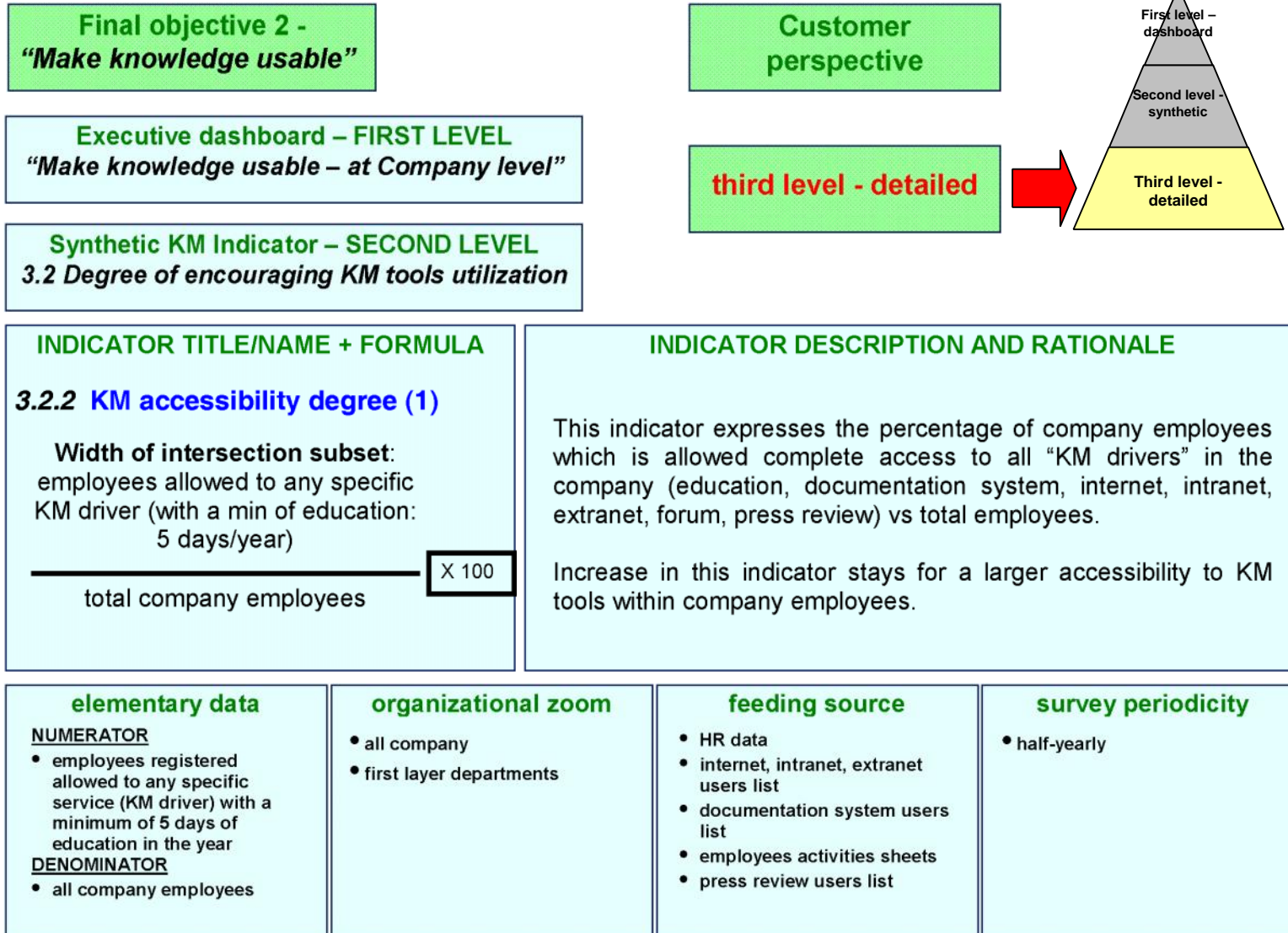
- 6 KM indicators of first level (executive dashboard)
- 18 KM indicators of second level (synthetic)
- 40 KM indicators of third level (detailed)

### 3 DIMENSIONS FOR KM INDICATORS



## Template 7

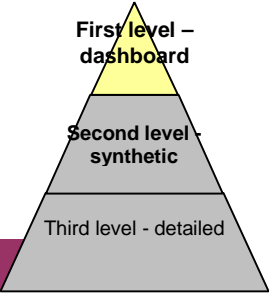
### A third level-detailed KM indicator (Overall company dimension)



# Template 8

## Executive dashboard for company KM indicators (overview)

### EXECUTIVE DASHBOARD OVERVIEW – 6 KM Indicators – FIRST LEVEL



#### OBJECTIVES and BALANCED SCORECARD PERSPECTIVES

#### OBSERVATIONS/DIMENSIONS

##### OVERALL COMPANY

##### CORE PRODUCTION BUSINESS PROCESSES

##### TOOLS AND SYSTEMS

*economic/financial*

*"Improve capability to satisfy institutional clients and perform better services"*

*1. Improve capability to fulfil company mission and relative coherences*

*customer*

*"Make knowledge usable"*

*2. Make knowledge usable – at Company level*

*3. Make knowledge usable – at core production business processes level*

*internal business processes*

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

*4. Evaluate organizational levers and solutions to support KM diffusion and re-use*

*learning and growth*

*"Manage the knowledge life cycle"*

*5. Generate, accumulate and develop knowledge – at Company level*

*6. Generate, accumulate and develop knowledge – at core production business processes level*



## Template 9

### Executive dashboard of KM indicators (KM indicator no. 4 – Tools and systems)

#### TOOLS AND SYSTEMS DIMENSION - KM INDICATORS (KPI)

<b>Objective</b>	<b><i>"Create new processes to enhance existing knowledge diffusion and exchange"</i></b>													
<b>DASHBOARD - FIRST LEVEL</b>		<b>code</b>	<b>KM INDICATOR TITLE/NAME</b>						<b>ACHIEVED</b>	<b>TARGET</b>	<b>D</b>			
		<b>4</b>	<b>Evaluate organizational levers and solutions to support KM diffusion and re-use</b>						50%	50%	0%			
<b>INDICATORS - SECOND LEVEL</b>	<b>WEIGHT %</b>	<b>code</b>	<b>KM INDICATOR TITLE/NAME</b>	<b>ACHIEVED</b>	<b>TARGET</b>	<b>D</b>	<b>WEIGHT %</b>	<b>code</b>	<b>KM INDICATOR TITLE/NAME</b>	<b>ACHIEVED</b>	<b>TARGET</b>	<b>D</b>		
	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%		
<b>DETAILED KM INDICATORS - THIRD LEVEL</b>	<b>WEIGHT %</b>	<b>code</b>	<b>KM INDICATOR TITLE/NAME</b>	<b>ACHIEVED</b>	<b>TARGET</b>	<b>D</b>	<b>WEIGHT %</b>	<b>code</b>	<b>KM INDICATOR TITLE/NAME</b>	<b>ACHIEVED</b>	<b>TARGET</b>	<b>D</b>		
	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%								

KM indicators measurement activities started in the company during winter 2004. During that period the project team helped to find initial standard to measure and confront in time, with established periodicity. In this sense any subsequent measurement served for monitoring improvement/worsening in any KM indicator (whichever dimension) and taking necessary corrective actions, including 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 of improvement of the KM measurement system designed.

## **1.8 Conclusions**

Working methodologies presented in the paper are based on collaborative and shared identification criteria of a knowledge management indicators system, for their subsequent measuring, evaluating and monitoring. In this sense the 'value of KM for the company' is evolutionary and semi-stable and may depend strongly (Sveiby, 2006) by the part of company involved in these topical decision: top management, experts and/or professionals that address their own open perception of a quantifiable dimension linked to knowledge (e.g. revenue, profit, quality, culture, organizational alignment, etc.).

The tools and indicators identified enable to measure periodically exchange of experiences and knowledge that happens in a company (Petrucciani, 1990) and permit, at the same time, to consider their trend/situation in time to intervene prevalently with: 1) cultural, educational and training actions, 2) direct organizational interventions to facilitate knowledge exchange on the job, 3) creation of communities of practices (CoP) and working group (Dalkir, 2005), even semi-permanent, based on critical knowledge-sharing.

The project highlighted that KM indicators selected are flexible, evolutionary and open to dynamic adaptation, following technological and application development for institutional clients reached by the company.

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