CoPs-Centered Knowledge Management

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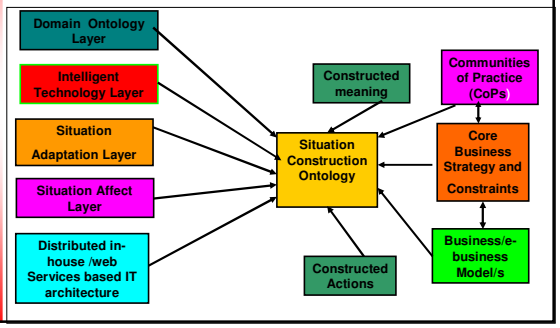
Outline

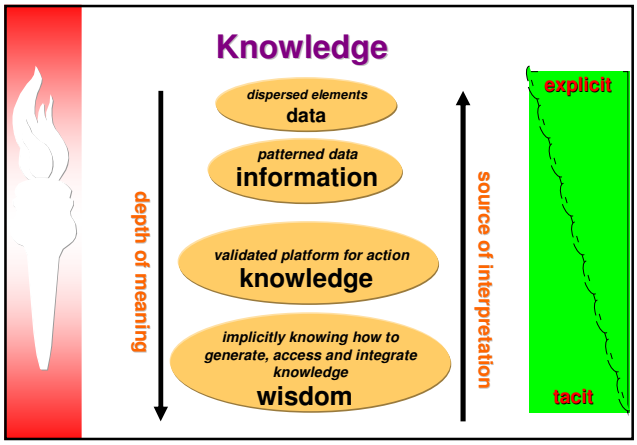
- Overview
- KM performance Statistics
- Technology Push Models or Strategy Pull Models
- KM Definitions
- Communties of Practice and Strategy alternatives
- Knowledge Management Architecture

Strategy-pull Model Driven Knowledge Management - Overview



KM Performance Statistics

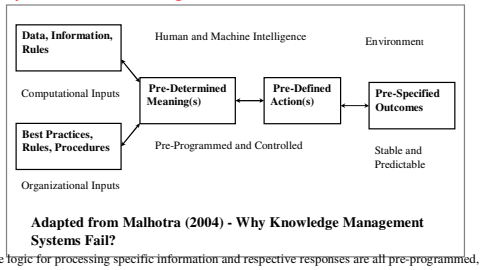
- Industry estimates have pegged the failure rate of technology implementations for business process reengineering efforts at 70 percent. Recent industry data suggest a similar failure rate of KM related technology implementations and related applications (Darrell et al., 2002, Malhotra 2005)



Knowledge Management Definition

- **Input-Driven KM Definitions**
  - Knowledge Management promotes an integrated approach to identifying, capturing, retrieving, sharing, and evaluating an enterprises information assets. These information assets may include databases, documents, policies, procedures, as well as the un-captured tacit expertise and experience stored in individual's heads. - Oracle Magazine, 1998
  - Knowledge management systems (KMS) refer to a class of information systems applied to managing organizational knowledge. That is, they are IT-based systems developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application'' (Alavi and Leidner, 2001)

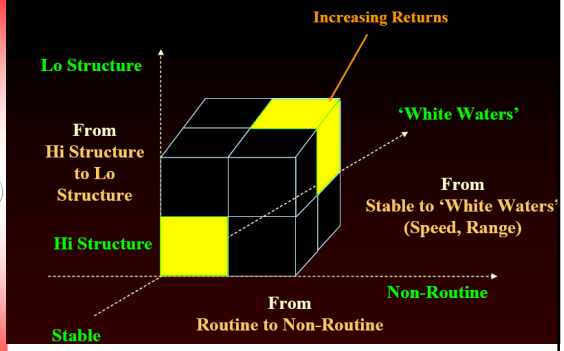
Knowledge Management – Technology Push Model – Good for Modelling Explicit Knowledge



Adapted from Malhotra (2004) - Why Knowledge Management Systems Fail?

The logic for processing specific information and respective responses are all pre-programmed, pre-configured, and pre-determined. The mechanistic information-processing orientation of the model generally does not encourage diverse interpretations of information or possibility of multiple responses to same information. Focus on Knowledge-reuse rather than Knowledge Creation. KMS are based on *doing the thing right* where the pre-specified inputs, processing logic, and, the outcomes are assumed to represent *the right thing*.

Dimensions of KM Performance



Source: Malhotra, Y., Why Knowledge Management Systems Fail? Enablers and Constraints of Knowledge Management in Human Enterprises . In Michael E.D. Koenig & T. Kanti Srikantaiah (Eds.), Knowledge Management Lessons Learned: What Works and What Doesn't, Information Today Inc. (American Society for Information Science and Technology Monograph Series), 87-112, 2004

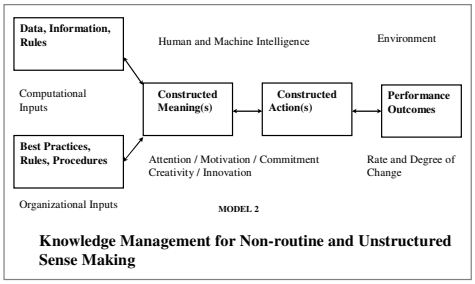
Knowledge Management Definition

- Processing-driven KM Definitions
  - ''KM entails helping people share and put knowledge into action by creating access, context, infrastructure, and simultaneously reducing learning cycles'' (Massey et al., 2001)
  - ''Knowledge management is a function of the generation and dissemination of information, developing a shared understanding of the information, filtering shared understandings into degrees of potential value, and storing valuable knowledge within the confines of an accessible organizational mechanism'' (CFP for *Decision Sciences* special issue on Knowledge Management, 2002)

Knowledge Management Definition

- Outcomes-driven paradigm of KM
  - ''Knowledge Management refers to the critical issues of organizational adaptation, survival and competence against discontinuous environmental change. Essentially it embodies organizational processes that seek synergistic combination of data and information-processing capacity of information technologies, and the creative and innovative capacity of human beings'' (Malhotra,1998b)

Knowledge Management – Strategy-pull Model



Knowledge Management for Non-routine and Unstructured Sense Making

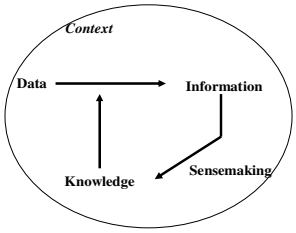
Constructing Meaning and Sensemaking

- Constructing meaning is based on individual's interpretation of a situation based upon there existing (or learnt) cognitive models, goals and tasks related to the situation; it represents the personal meaning or sense ascribed to information related to certain task or situation. This description is theoretically underpinned in the area of sensemaking and naturalistic decision making which as the name suggests is about constructing (or interpreting) meaning or making sense of a given situation
- Knowledge acts as an interpretant to turn data into information.
- In a given situation, we may encounter familiar as well unfamiliar or new information. The new information causes some level of dissonance prompting the question "What's the story here?". In the process of resolving this dissonance we create knowledge
- Sensemaking process takes place in a context. Data to one person is someone else's information.

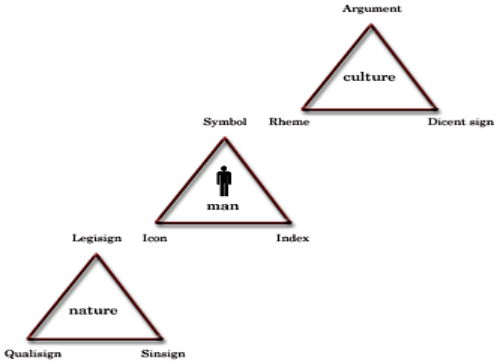
Constructing Meaning and Sensemaking

- For purpose of interpreting, constructing meaning and resolving the dissonance, people engage in organised sensemaking which involves use of cognitive constructs for labeling and categorizing to stabilize the streaming of experience. The process of labeling and categorisation involves connecting abstract and impersonal concepts with concrete and personal concepts which are amenable to functional deployment. For example, functional deployment may involve diagnostic labels in medicine that suggest a plausible action or treatment

Interplay Between Sensemaking, Data, Information and Knowledge.



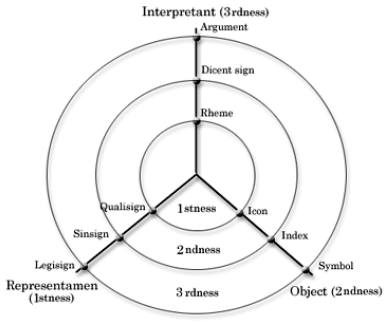
Knowledge Types Based on Semiotic Theory - Triad of Signs Nature, Human and Culture



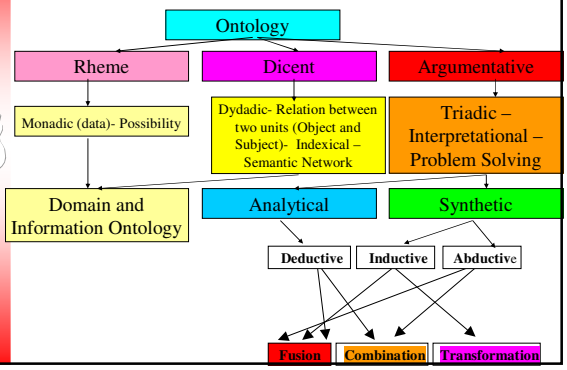
Three Trichotomies of Signs (Sheriff (1989) - Signs of Nature, Signs of Humans and Signs of Culture

A sign is: (Signs of Nature)	a "mere quality" QUALISIGN (e.g., red color)	an "actual existent" SINSIGN (e.g., red cloth)	a "general law" (or perceptual habit) LEGISIGN
A sign relates to its object in having: (Signs of Humans)	"some character in itself" (e.g. metaphor, picture of Eiffel tower)) ICON	"some existential relation to that object" (e.g. symptom to a disease) INDEX	"some relation to the interpretant" SYMBOL (e.g. influenza, cat)
A sign's interpretant represents it (sign) as a sign of: (Signs of Culture)	"possibility" RHEME (e.g., nouns can be referred as possible objects) – Domain concepts	"fact" DICENT (e.g., Whole Sentences) Information Ontology – Semantic Network	"reason" ARGUMENT

Triad of Signs



Knowledge Ontologies Based on Semiotic Theory



Tacit to Explicit Knowledge Conversion Modes and their Technology Models

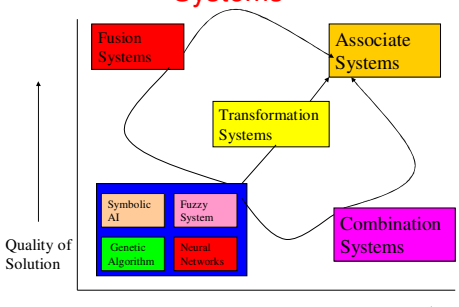
Tacit FROM Explicit	Tacit TO Tacit	Tacit TO Explicit
Tacit FROM Tacit	Socialization	Externalization
Explicit FROM Explicit	Internalization	Combination

Nonaka and **Takeuchi** "The Knowledge-Creating Company," Oxford University Press (**1995**).

Tacit FROM Explicit	Tacit TO Tacit	Tacit TO Explicit
Tacit FROM Tacit	Modular NNs	Transformation
Explicit FROM Explicit	Fusion	Combination

Khosla and Dillon "Engineering Intelligent Hybrid Multi-agent Systems ," Kluwer Academic Publishers, 1997

Human-Centeredness and Associate Systems



Classes of Intelligent Hybrid Systems (**Khosla and Dillon** "Engineering Intelligent Hybrid Multi-agent Systems ," Kluwer Academic Publishers, 1997

Communities of Practice (CoPs) - Knowledge Communities (KC)

KC is always adopted to implement organizational transformation, and have a critical role.

Definition of CoPs

A group of people who …

Domain … share an interest in a topic
- understand what the issues are
- agree on common approaches

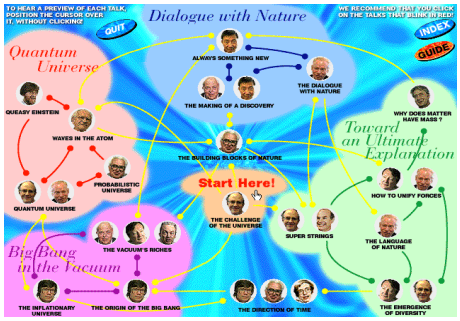
Community … interact and build relationships
- help each other solve problems and answer questions
- network across teams and business units

Practice … share and develop knowledge
- share information, insights, and best practices
- build tools and a knowledge base

... and so contribute to the success of the organization.

Knowledge Communities (KC)

KC

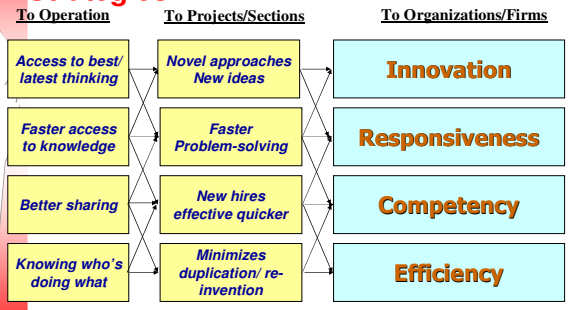


Strategic Tools in the Knowledge-Driven Organization

Strategy Alternatives

- The first strategy alternative is **Induced Innovation.** This features cross-domain sharing to facilitate innovation according to common interests. CoPs using such a strategy also provide a safe, or low-cost, infrastructure for trial and error attempts.
- The second strategy alternative is **Promoted Responsiveness.** This stresses the importance of collecting and classifying knowledge to provide pre-warning signals or issue-oriented solutions to members to speed up their reactions to particular events and issues.
- The third strategy alternative is **Increased Core Competency.** Members in the CoPs share their experiences with others and access domain experts easily. CoPs enable the spreading of knowledge between senior and junior members and disseminate the organization's commonalities and norms effectively.
- The fourth strategy alternative is **Enhanced Working Efficiency.** CoPs reuse existing intellectual property, share related documents and authors' information, and enhance productivity with easy to study practical knowledge

Achievements of CoPs and KM Strategies



Characteristics Comparison of each CoPs Strategy Alternative

Dimension alternatives	Connection	Interface	Entity	Performance	Key point
Induced Innovation	Support new ideas and creativity	Establish safe infrastructure for new thinking	Common Interest	Profit Up	Group Leaning
Promoted Responsiveness	Find people with similar experience	Willing to respond to problems	Common Language	Profit Up	Reuse IA
Increased Core Competency	Find experts	Coach of new knowledge	Regulation	Cost Down	Group Learning
Enhanced working Efficiency	Find developed practice	Positive Recognition	Know How	Cost Down	Reuse IA

Assumptions

Relationship to Strategy

- Strategy focus – creating a distinctive set of organizational capabilities
- Capabilities – focal point from which strategies are built
- Capabilities generate the organization's value and produce results
- Organizational performance depends on quality and reach of its strategies
- Success is based on the organization's ability to provide the necessary capabilities for individuals to take effective action

Assumptions

Communities of Practice are situated in a strategic context

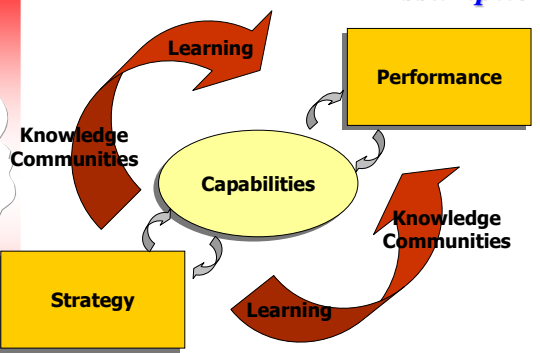
- Aligned with strategic imperatives
- Create the capabilities needed to link strategy with performance
- Generate meta-capabilities and new knowledge
- Create organizational readiness for change – (e.g.Value Creation Networks)
  - Multiple partners with individual expertise
  - Collaboration and partnership capabilities and mindsets
  - Technology enabled

Assumptions

Strategic Purpose of Communities

- **Strategic theme:** aligned with a strategic imperative
- **Common development need:** focused on increasing individual capabilities
- **Distributed functional expertise:** provides forum for dispersed expertise
- **Cross-generational knowledge exchange:** creates peer learning space to address demographics

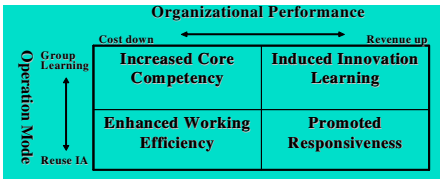
Assumptions



Empirical Analysis

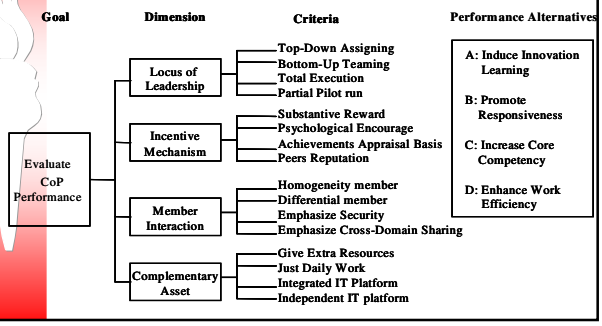
KC Achievement Matrix

In order to realize this target, locus of leadership, incentive mechanism, member interaction, and complementary asset should take into consideration and evaluation.



This research develops KC achievement matrix, using **Induced Innovation Learning**, **Promote Responsiveness**, **Increase Core Competency**, and **Enhance Working Efficiency** to be the four kinds of achievements, enable to choose the right way and distinguish future trend.

Modelling and Evaluating CoPs – Dimensions, Criteria and Performance Alternatives



Survey based on 16 Criteria and Four Strategy Alternatives

- Study involved survey of members of Industrial Technological Research Institute, Taiwan using the 16 criteria
- Members responses were used to determine the weight they assigned to each criteria (normalised between 0 and 1) and ranking of each criteria
- Members also scored the effectiveness of four strategy alternatives against each criteria on scale of 0 to 100.

Empirical Analysis

Average Weight (Ranking) of 16 criteria

Criteria	Locus of Leadership				Incentive Mechanism			
	Top-Down Assigning	Bottom-Up Teaming	Total Execution	Partial Pilot run	Substantive Reward	Psychological Encourage	Achievement& ppraisal Basi	Peers Reputation
Weight (Ranking)	0.075 (4)	0.037 (15)	0.044 (13)	0.059 (9)	0.074 (5)	0.042 (14)	0.095 (2)	0.053 (11)
Criteria	Member Interaction				Complementary Asset			
	Homogeneity member	Differential member	Emphasize Security	Emphasize Cross-Domain Sharing	Give Extra Resource	Just Daily Work	Integrated IT Platform	Independent IT platform
Weight (Ranking)	0.055 (10)	0.068 (6)	0.067 (7)	0.098 (1)	0.067 (7)	0.045 (12)	0.086 (3)	0.037 (15)

Evaluation of CoPs survey - FUZZY MCDM - NON-ADDITIVE FUZZY INTEGRAL METHOD

- In traditional multi-attribute evaluation approaches, each attribute must be independent of the others
- Characteristics that have interactions and mutual influence among attributes or criteria in a real system cannot be handled by the concept of traditional additive measures alone
- To assess CoPs criteria and strategy alternatives, it is more appropriate to apply a fuzzy integral model in which it is not necessary to assume additivity and independence.
- This research adopts fuzzy MCDM to evaluate each of the possible strategy alternatives in a dynamic environment with multiple dimensions
- Fuzzy integral computes the maximal grade of agreement between the objective evidence and expectation

Evaluating CoPs - Non-Additive Fuzzy Integral Method

- Fuzzy measure can be considered as generalization of the classical probability measure. A fuzzy measure **g** over a set **X** (the universe of discourse with the subsets **E**, **F**...) satisfies the following conditions when **X** is finite:
- 1. when **E** is an empty set then $g(E) = 0$.
- 2. $g(X) = 1$.
- 3. when **E** is a **subset** of **F**, then $g(E) < g(F)$.
- In practice, g represents the grade of subjective importance of each criterion.

Evaluating CoPs - Non-Additive Fuzzy Integral Method

Sugeno (1974) introduced the theory of fuzzy measures and fuzzy integrals. A fuzzy measure g over a set X (the universe of discource with the subsets E, F, ...) satisfies the following conditions (X is finite):

$$1)\ g(\varnothing)=0,\quad g(X)=1$$

$$2)\ \text{If } E\subset F, \text{ then } g(E)\le g(F)$$

A fuzzy measure is a Sugeno measure (or a -fuzzy measure) if it satisfies the following additional condition :

$$g_\lambda(E\cup F)=g_\lambda(E)+g_\lambda(F)+\lambda\cdot g_\lambda(E)\cdot g_\lambda(F)$$

The value of can be calculated regarding to the condition g(X)=1:

$$\lambda+1=\prod_{i=1}^{n}(1+\lambda g^i).$$

$$g_\lambda(\{x_1^k,x_2^k,\ldots,x_n^k\})=\frac{1}{\lambda}[\prod_{i=1}^{n}(1+\lambda g_\lambda(\{x_i^k\}))-1]$$

Evaluating CoPs - Non-Additive Fuzzy Integral Method

- In the ranking of effective values between criteria *A* and *B*, there are three conditions:
- If $\lambda>0$, then , $g_\lambda(A\cup B)>g_\lambda(A)+g_\lambda(B)$ which represents the multiplicative effect occurring between *A* and *B*;
- If $\lambda=0$, then , $g_\lambda(A\cup B)>g_\lambda(A)+g_\lambda(B)$ which represents the additive effect occurring between *A* and *B*;
- If $\lambda<0$, then , $g_\lambda(A\cup B)>g_\lambda(A)+g_\lambda(B)$ which represents the substitutive effect occurring between *A* and *B*.

Evaluating CoPs - Non-Additive Fuzzy Integral Method

Example for calculation of Sugeno measure

Consider the set X={a, b, c}. The fuzzy density values are given as follows:

$$g^i=\begin{cases}0.3 & \text{if } i=a,\\ 0.4 & \text{if } i=b,\\ 0.1 & \text{if } i=c.\end{cases}$$

The value of can be calculated by solving the following equation:

$$1+\lambda=(1+0.3\lambda)(1+0.4\lambda)(1+0.1\lambda)$$

The solutions are λ ={-16.8, 1}. Regarding to the condition λ > -1, we receive λ =1 as only solution.

Evaluating CoPs - Non-Additive Fuzzy Integral Method

The Sugeno measure can be constructed as follows:

{a}	g({a}) = 0.3
{b}	g({b}) = 0.4
{c}	g({c}) = 0.1
{a, b}	g({a, b}) = g({a}) + g({b})+ λg({a}) g({b}) = 0.82
{a, c}	g({a, c}) = g({a}) + g({c})+ λ g({a}) g({c}) = 0.43
{b, c}	g({b, c}) = g({b}) + g({c})+ λ g({b}) g({c}) = 0.54
{a, b, c}	g({a, b, c}) = g(X) = 1

Fuzzy Integral – Sugeno measure

The fuzzy integral of *h* with respect to *g* gives the overall assessment of the alternatives. In practice h represents actual performance of the criterion

Let X be a set of elements (e.g. features, sensors, classifiers). Let h: X-->[0,1]. h(x) denotes the confidence value delivered by element x (e.g. the class membership of data determined by a specific classifier). The fuzzy integral of h over E (a subst of X) with respect to the fuzzy measure g can be calculated as follows:

$$\int_E h(x) \circ g = \sup_{\alpha \in [0,1]} \left[\alpha \wedge g\left(E \cap H_\alpha\right) \right];$$

with $H_\alpha = \left\{ x \,|\, h(x) \geq \alpha \right\}$.

If we have always finite sets of elements X={x1, x2, ..., xn} and If the elements are sorted so that h(xi) is descending function the fuzzy integral can be calculated as follows:

$$\int h(x) \circ g = \bigvee_{i=1}^{n} \left[h(x_i) \wedge g(H_i) \right];$$

with

$$H_i = \left\{ x_1, x_2, \cdots, x_i \right\}$$

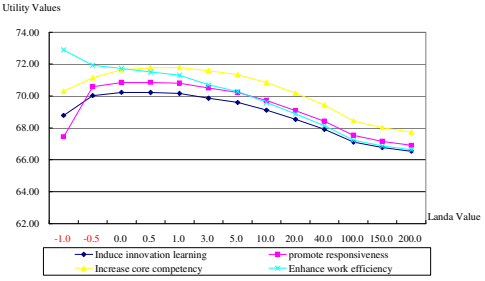
Ranking of Four Strategy Alternatives based on survey results and Fuzzy Integral Method

Ranking		Alternatives
SAW	Alternative $C \succ D \succ A \succ B$	*A*: Induced Innovation
λ=-1	Alternative $D \succ C \succ A \succ B$	*B*: Promoted responsiveness
λ=-0.5	Alternative $D \succ C \succ B \succ A$	*C*: Increased core competency
λ=0	Alternative $D \succ C \succ B \succ A$	*D*: Enhanced work efficiency
$0 < \lambda < 10$	Alternative $C \succ D \succ B \succ A$	

Evaluating CoPs in terms of Strategy Alternatives

λ	(-1.0)	(-0.50)	0.00	**0.50**	**1.00**	**3.00**	**5.00**	10.00	20.00	40.00	100.00	150.00	200.00	(SAW)
A	68.79	70.03	70.23	**70.22**	**70.17**	**69.86**	**69.59**	69.11	68.53	67.91	67.10	66.77	66.54	71.36
B	66.74	70.58	70.84	**70.85**	**70.80**	**70.50**	**70.22**	69.71	69.09	68.41	67.53	67.16	66.90	70.16
C	70.31	71.15	71.64	**71.77**	**71.78**	**71.59**	**71.34**	70.84	70.18	69.45	68.45	68.02	67.73	73.52
D	72.89	71.93	71.73	**71.51**	**71.31**	**70.69**	**70.27**	69.60	68.87	68.14	67.23	66.86	66.62	73.38

Effective values of Strategy alternatives on CoPs



Analysis of CoPs and Strategy Alternatives

- When $\lambda < 0$, there are substitutive effects between the four strategy alternative
- When $0 < \lambda < 10$, there are multiplicative effects and the ranking is the same
- **Increased Core Competency** is the most highly emphasized;
- However, when $\lambda > 10$, the ranking changes
- According to empirical experience, the criteria of this research have multiplicative effects, so we adopt the final value and ranking of $0 < \lambda < 10$
- Among the four alternatives, the effective value of **Increased Core Competency** is the highest, followed by that of **Enhanced Work Efficiency**, **Promoted Responsiveness**, and **Induced Innovation** respectively.

High Weight and Low Effective Value

Dimension/Criteria / Weight/Effective Value	Weight of cross dimension	**Induced Innovation**	**Promoted Responsive-ness**	**Increased Core Competency**	**Enhanced Work Efficiency**
Locus of Leadership					
Top-Down Assigning	0.075	**65.6**	70.3	79.0	77.0
Bottom-Up Teaming	0.037	78.8	71.7	71.5	69.8
Total Execution	0.044	63.9	72.3	72.1	73.5
Partial Pilot run	0.059	74.5	67.7	74.6	70.8
Incentive Mechanisms					
Substantive Reward	0.074	69.7	69.3	74.6	77.2
Psychological Encouragement	0.042	77.6	71.8	72.1	73.7
Achievements Appraisal Basis	0.095	**70.4**	73.5	76.9	78.8
Peer approval	0.053	77.7	71.6	73.1	80.2
Member Interaction					
Homogeneity of members	0.055	58.1	67.2	72.2	75.0
Differential members	0.068	81.4	68.2	70.2	66.5
Emphasis on Security	0.067	56.0	56.9	67.0	63.4
Emphasis on Cross-Domain Sharing	0.098	83.3	74.9	75.2	**70.2**
Complementary assets					
Supplying Extra Resources	0.067	73.7	**71.5**	74.6	74.3
Routine Daily Work	0.045	59.3	65.5	67.1	69.5
Integrated IT Platform	0.086	76.1	77.0	77.0	80.4
Independent IT platform	0.037	65.6	65.7	68.9	65.0

Analysis of CoPs and Strategy Alternatives

- Instead of qualitatively assessing the issue of CoPs, this research provides a practical quantitative model and approach for research institutes and enterprises to conduct their own CoPs research in the knowledge-based economy. Before distributing the research questionnaires, we conducted a pre-test with experts to both help us modify our questions to ensure accessibility, and to help us choose important dimensions and criteria. Through the experts' review of and input into the survey design, this research identifies four dimensions and sixteen critical criteria in the CoPs research area. We utilized pair wise comparison in the first level to establish the relative importance of the four strategic constructions and, repeated this in the second level for criteria-weighting, and finally concluded various AHP weights.

Analysis of CoPs and Strategy Alternatives

- Weights Assigned to Dimensions and Criteria
  - By employing fuzzy logic, the decision-making methodology eliminates the issue of criteria independent assumptions. The minimal difference among the four dimensions implies that they are equally important. Nevertheless, the dimension weighting of **Member Interaction** was the highest, which indicates people interface is key to knowledge sharing and emphasizes the human aspect of CoPs. This result again supports the idea that the essence of a community is its members and that they organize themselves and participate because they get value from their participation. **Incentive Mechanisms** was weighted the second. The result supports the idea that when you reward people for certain behavior, for example, sharing knowledge, they will want to do it more. Therefore, developing meaningful rewards is essential to sustaining community goals and achieving a knowledge-centered organization.
  - Among the sixteen criteria, **Emphasis on Cross-Domain Sharing** in relative importance to other criteria indicates that CoPs practitioners hope to break through boundaries in new thinking and work patterns while enlarging cross field synergy by way of mutual exchange and integration.

Analysis of CoPs and Strategy Alternatives

- Perception of the Assessment of CoPs
  - Apart from functional divergence, many organizations consist of different divisions with distinct projects targeting correspondent industries and customers. This mix usually causes different acknowledgements and choices of strategies inside CoPs. When first implementing CoPs, such disagreements may even be major obstacles in their functioning. In addition, differences in strategic preferences bring about not only different outcomes but also different operational modes and preferred performances.

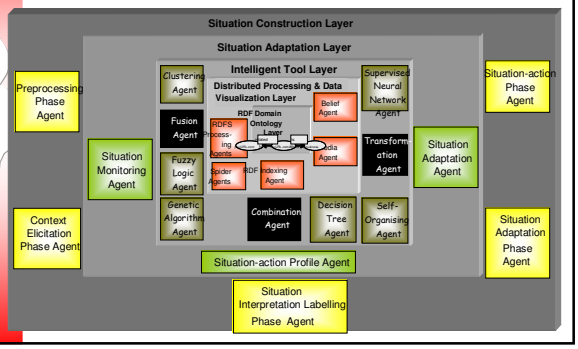
Analysis of CoPs and Strategy Alternatives

- Final Ranking of the Fuzzy Integral
  - In the possible rankings we surveyed, we found that when $0 < \lambda < 10$, four alternatives have the same ranking with non-additive multiplying value. As for utility value, **Increased Core Competency** is the highest, which may provide obvious benefits as a starting point when **Induced Innovation** becomes the greatest benefit in the future.
  - After analyzing the survey results, this research provides insight into preferences for the strategy alternatives created by CoPs. The results show that there are gaps between the effective value (scores 56.0 to 80.2) and ideal value (score 100) of CoPs and provide directions by which to improve the CoPs' performances. The criteria with high weights but low effective values should be improved first.

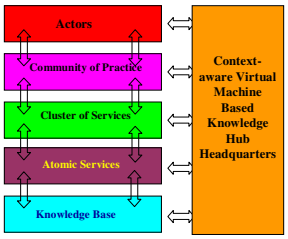
Application - Knowledge Management in Regional Communities

- The *Regional Innovation Leadership* (RIL) cycle has been chosen as the background environment because it synthesizes the main scientific contributions related to innovation and territorial business development based on the strategic role that is played by knowledge. These contributions highlight the importance of knowledge as enabling factor for building sustainable competitive advantage at territorial level.
- According to region-enterprise metaphor, RIL represents "the collective capacity of a regional community to initiate and sustain significant changes to work effectively with forces that shape change".
- RIL cycle is supported by a number of methodologies and tools for promoting territorial cluster-based development, fostering interactive learning and innovation processes, assisting and sustaining local institutions and policy makers in their planning activities.
- The organizational form we want to support for feeding the RIL cycle is the *community of practice* (CoP).
- Final goal is to create and maintain a complex knowledge management system for knowledge sharing and decision support which is aimed at a community of entrepreneurs, businessmen and government officials, enabling *Regional Innovation Leadership* (RIL)

Knowledge Management IT Architecture- Context-Aware Virtual Machine (CAVM)



Regional Innovation Life Cycle Knowledge Hub Architectural Model



Actors – Regional Innovation Leadership (An Example)

- The *Regional Innovation Leadership* (RIL) cycle has been chosen as the background environment because it synthesizes the main scientific contributions related to innovation and territorial business development based on the strategic role that is played by knowledge. These contributions highlight the importance of knowledge as enabling factor for building sustainable competitive advantage at territorial level.
- The actors identified that interact with the Knowledge Hub belong to the following communities:
  - Local and regional institutions, directly involved in planning and carrying out territorial growth and innovation projects;
  - Local entrepreneurs and trade associations, representing the economical power resource of a territory;
  - Citizens and government officials, directly or indirectly involved in the local growth;
  - Corporate headquarters and enterprises, attracted by new favorable environmental conditions and potentially interested in investing in the territory;
  - Public and private research centers, representing the main source of innovation.

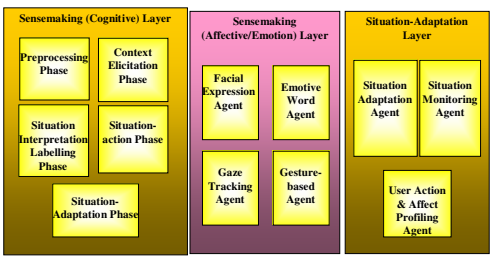
Cluster of Services

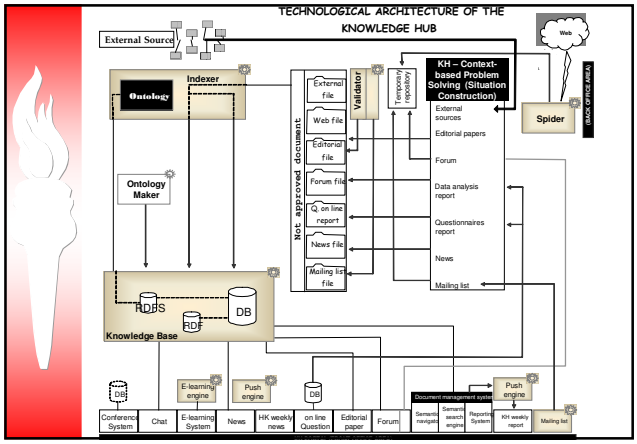
- The Knowledge Hub is aimed at empowering all above categories of users and amplifying the network of existing relations among the typologies of actors
- This purpose is achieved by increasing the frequency and effectiveness of their learning and knowledge sharing processes, through the organization of a *front office* area composed by dynamically configurable clusters of services.
- Knowledge Hub is able to presents a different, tailored set of atomic services to each Community of practice, satisfying their needs and enhancing their potentialities
- The front-office area is organized as a Web-based portal and functionally corresponds to the *Belief Agent* in the distributed processing layer of the Context-Aware Virtual Machine (CAVM). It represents the interface to the system through which the Knowledge Hub actors' beliefs are checked, imported into the system and converted into knowledge to be semi-automatically associated with concepts maintained by the RDF agents in the distributed processing layer of the CAVM. The decision support, optimization and intelligent tool agent layers of CAVM also provide added functionality to the user in the front-office area.

Three Levels of Behaviour for Sensemaking and Situation Construction in CAVM

Behavioral level	**Situation Awarenes s**	**Inference/Reasoning (cognitive function)**	**Corresponding CAVM Constructs**	**Leveraging CAVM Layer**	**Leveraging CAVM Agents (some)**
Perception-action level	Sensing	Reflex/Reactive inference based on skills	Preprocessing	Reactive-agent Layer	Data aggregation, Data visualisation
Procedural level	Situation recognition as a pattern matching activity	Remembering a rule or procedure: If Situation then Algorithm of actions	Learnt patterns, rules and associations	Intelligent Technology Agent Layer	Neural Network, Clustering, fuzzy-neuro fusion agents
Constructive level	Situation constructio n	Formulating hypotheses and decision pathways that involve possible actions, constraints and resources	Context Elicitation Phase, Context-based Situation Interpretation Labeling Phase, Situation-action phase, Situation Adaptation Phase	Sensemaking (cognitive) Layer, Situation-Adaptation Agent Layer Sensemaking (affective) Layer	Situation Monitoring, Situation Adaptation, User-Profiling, Non-verbal Affective agents

KM Architecture Agents





Knowledge Hub Agents

- Indexing Agent
  - creates the link between documents and knowledge base. It allows associating to a document some concepts or semantic assertions, structured as subject-predicate-object sentences.
- Spider agent
  - finds new knowledge items to be inserted in the knowledge base. The Knowledge Hub Headquarters members configure the spider using a web-configuration facility.
- Validator agent
  - allows adding notes and comments, distinguishing keeping them separate from the rest of the document. In this way, each member of a community of practice (CoP) can visualize both the notes and their authors, individuating immediately the core part of a document.

Indexing Process

- For example, referring to the semantic assertion “Current document/Xpath speaks about an enterprise”, the system will generate the following RDF statement:
  - 1. <[xpath], indi:speak_about, onto: enterprise>

The indexing agent allows for specifying not only a set of concepts, but also their instances referring to the semantic assertion “Current document/Xpath speaks about the enterprise ACME”

1. <[xpath], indi:speak_about, doc:ID_01>
2. < doc:ID_01, rdf:type, onto: enterprise>
3. < doc:ID_01, indi:name, "ACME">

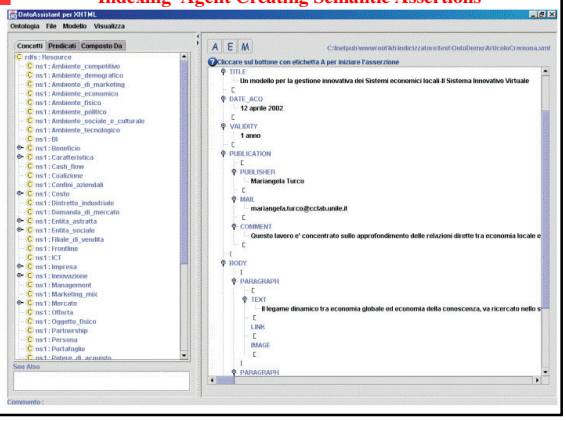
Indexing Process

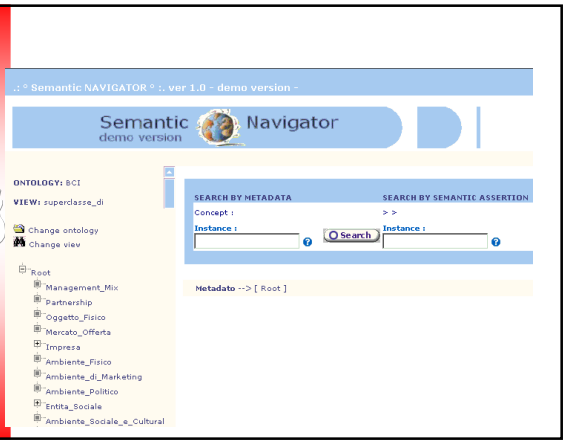
Example:

Current document/Xpath speaks about enterprise that invest in technology", the system will generate the following set of RDF statements:

1. <[xpath], indi:assert, doc_st_01>
2. <doc_st_01, rdf:type, rdf:statement>
3. <doc_st_01, rdf:subject, onto:enterprise>
4. <doc_st_01, rdf:predicate, onto:invest>
5. <doc_st_01, rdf:object, onto:technology>

Indexing Agent Creating Semantic Assertions





Conclusion

- CoPs and Strategy alternatives used as central theme for design KM systems
- Study of CoPs conducted in industry
- Study Shows that CoPs exist beyond functional boundaries in organisations
- KM approach based on mix of Technology push model (largely explicit knowledge) and Strategy-pull model
- Fuzzy Integral method used for MCDM
- Sensemaking modeled using situation construction and adaptation constructs
- Three levels of behaviour employed for situation modeling
- Dynamic user adaptation and optimization for constructing new meaning
- Also intend to model human emotional states as part of KM in future work (situation-action-affect profiles) – Implications for e-learning
- Multi-layered multi-level KM architecture