

Knowledge Management models: a state of the art

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(a version with all figures will be available soon)

The following is selection of models and classification systems that appeared in the literatures defined above. These are, in our opinion, representative but certainly not an exhaustive collection of such devices in what may be termed the domain of Knowledge Management. The following sections present a brief description of each model or classification system and constrains the discussion to its dimensional structure.

SECI (Nonaka)

Ikujiro Nonaka, a professor at Hitotsubashi University and the University of California at Berkeley, articulated a model of "knowledge creation" in a series of articles and books dating from the early 1990s. The SECI (Socialization, Externalization, Combination, Internalization) model first appeared in 1991 and attained recognition as a useful and rigorous approach to describing the ways knowledge is generated, transferred and re-created in organizations. In brief, the model incorporates the following:

- Two forms of knowledge (tacit and explicit)
- An interaction dynamic (transfer)
- Three levels of social aggregation (individual, group, context)
- Four "knowledge-creating" processes (socialization, externalization, combination and internalization).

The model proposes that a "knowledge-creating company" consciously facilitates the interplay of tacit and explicit forms of knowledge. This is accomplished through systems and structures, and a corporate culture, which facilitate the interaction of four knowledge-creating processes, per the following:

- Socialization: the sharing of tacit knowledge between individuals through joint activities, physical proximity.
- Externalization: the expression of tacit knowledge in publicly comprehensible forms.
- Combination: the conversion of explicit knowledge into more complex sets of explicit knowledge: communication, dissemination, systematization of explicit knowledge.
- Internalization: the conversion of externalized knowledge into tacit knowledge on an individual or organizational scale. The embodiment of explicit knowledge into actions, practices, processes and strategic initiatives.

Critical for Nonaka is the interaction dynamic between forms of knowledge and levels of organization. He proposes that the spiral resulting from the exchange of tacit and explicit knowledge across different organizational levels is the key to knowledge creation and re-creation. The prescription is that companies should recognize the importance of this interaction dynamic and imbed the mechanisms

that make it possible.

In 1998 Nonaka & Konno introduced the concept of Ba, which relates to the English concept of place. A Ba in Knowledge Management is a space for dynamic knowledge conversion and emerging relationships. Four Bas are defined by Nonaka:

- *Originating Ba*: a space where individuals share feelings, emotions, experiences and mental models.
- *Interacting Ba*: a space where tacit knowledge is made explicit. Two key factors are dialogue and metaphors.
- *Cyber Ba*: a space of interaction in a virtual world. Implicates the combination of new and existing explicit knowledge to generate new explicit knowledge throughout the organization.
- *Exercising Ba*: a space that facilitates the conversion of explicit knowledge into tacit.

Ba calls attention to the fact that knowledge is context-dependent: it cannot be separated from its "place" in any meaningful way. Each knowledge-creating process therefore requires a Ba, a phenomenal space whose importance should be recognized by the organization. The organization, in fact, should focus significant attention on the development of its Bas since more is to be gained by developing the environment around knowledge processes than efforts directed at the processes themselves.

The N-Form Organization (Hedlund)

Gunnar Hedlund of the Stockholm School of Economics introduced the notion of the N-Form corporation in 1994. He proposed that the N-Form corporation goes beyond the M-Form in that it better accommodates the emerging imperatives of knowledge-based organizational design, drawing its synthetic wisdom from the, "...gray zone between economics, organization theory and strategic management" (1994: 74). Hedlund suggests that a principal attribute of the model is its conjoint analysis of two sets of concepts: tacit/explicit knowledge, and four levels of social aggregation. He injects into these a set of dynamics related to knowledge creation, development, transfer and use, yielding a structure that is built around 3 basic dimensions:

- Two types of knowledge (tacit and articulated), and within each type three forms of knowledge (cognitive, skill, embodied)
- Four levels of carrier (individuals, small groups, organizations, the inter-organizational domain)
- The dynamics of knowledge transfer and transformation, which are articulated by the following processes:
 - Articulation and internalization, the interaction of which is reflection,
 - Extension and appropriation, the interaction of which is dialogue,
 - Assimilation and dissemination which refer to "... knowledge imports from and exports to the environment" (1994: 76).

Hedlund lays the foundation for his dynamic model by distinguishing between types, forms and levels of knowledge. In brief, he juxtaposes tacit and articulated knowledge (attending closely to definitional

issues) with different levels of social aggregation. This results in a classification scheme that assumes cognitive, skill-based and embodied forms of knowledge exist in both tacit and articulated forms across the range of organizational levels .

On this foundation Hedlund then situates the dynamics of knowledge transfer and transformation. He writes that most existing works speak, "...*primarily in terms of storage of information, and only secondarily about its transfer, whereas its transformation is left outside most analyses*" (1994: 76).

Knowledge transfer, storage and transformation are presented as a set of processes whose interactions, across the different types and levels of knowledge, privilege knowledge creation and, in turn, argue for the N-Form organizational design. The articulation of tacit knowledge, and the internalization of articulated knowledge, may occur at any level of carrier and the interaction, termed reflection, is held to be a primary source of knowledge creation.

The acquisition of tacit or articulated knowledge by lower agency levels, termed appropriation, and the dissemination of tacit or articulated knowledge to higher agency levels, termed extension, signal the movement of knowledge through different levels of carrier. Their interaction is termed dialogue whose, "...*quantity and quality are hypothesized to be important determinants of the type and effectiveness of knowledge management in an organization*" (1994: 77).

Knowing and Knowledge (Earl)

Michael Earl of the London Business School is known for the work he has conducted on the information systems function in organizations, the role of the CIO and more recently, the role of the CKO. His more recent works propose a set of heuristics that situate the CKO / knowledge function within organizations and prescribe its activities.

One distinction he makes, often discussed by others, is that of data, information and knowledge. Earl proposes a classification and writes, "*Trite and imperfect as this classification is, it suggests that knowledge comprises expertise, experience, know-how, skills and competence...*" (1998: 7).

Going further, he recognizes two organizational states that are relevant to Knowledge Management: knowledge and knowing.

Earl proposes that an organization may usefully concern itself with the creation, protection and leveraging of its knowledge assets by attending to four functions:

- Inventorising: mapping individual and organizational knowledge,
- Auditing: assessing the nature and extent of planned ignorance and then developing knowledge through learning activities,
- Socializing: creating events which enable people to share tacit knowledge,
- Experiencing: addressing the problem of unknown ignorance by learning from experience, action and handling unusual situations.

The OK Net and the OCS (Carayannis)

Elias Carayannis (George Washington University) has recently proposed a "...*synergistic symbiosis between information technology and managerial and organizational cognition*" (1999: 219) whose conjunction is Knowledge Management. IT is approached as a value-adding technological infrastructure, managerial / organizational cognition as the "...*capability for individual and collective reasoning, learning, emoting and envisioning,*" and Knowledge Management as "...*a socio-technical system of tacit and explicit business policies and practices*"(1999: 219). In general terms Carayannis attempts to define the systems and structures, both real and virtual, which would allow an organization to maximize the efficiency and effectiveness of its cognitive processes.

The crystallized form of this effort is termed the Organizational Knowledge Network or OK Net.

Carayannis specifies a number of concepts to lay its foundation and among them, the key elements of meta-cognition, meta-learning and meta-knowledge. A familiar theme in the organizational learning community, Carayannis states that the relationship between knowledge (K) and meta-Knowledge (MK)

is critical in Knowledge Management. He defines a 2 X 2 matrix which, "...consists of successive knowledge cycles where an individual or an organization can transition or traverse 4 stages of awareness and ignorance" (1999:224). Four possible states of organizational Knowledge Management obtain:

- Ignorance of ignorance (K, MK)
- Ignorance of awareness (K, MK)
- Awareness of ignorance (K, MK)
- Awareness of awareness (K, MK)

Organizations may thereby plot their situation(s) in one of these cells and a development effort is aimed at managing the transitions from one state to another. The ideal is awareness—of knowledge, of ignorance—and the willingness to move from the latter to the former. Transitions may be accomplished via two paths: connectivity or interactivity. Connectivity is enabled by information technology and held to be the efficiency-driven path. Interactivity denotes sociotechnical phenomena and emphasizes the tacit / explicit interplay in human interaction. Managed correctly, it engenders not only a spiral of increasing wisdom (meta-knowledge), but also learning how to learn.

Three Pillars of Knowledge Management (Wiig)

Karl Wiig is one of the pioneers in the field of Knowledge Management and was among the first to publish a series of texts that assembled management-relevant concepts focusing squarely on the topic. His overarching framework is based on three pillars and a foundation.

Wiig proposes that the foundation of Knowledge Management is comprised of the way knowledge is created, used in problem solving and decision making, and manifested cognitively as well as in culture, technology and procedures. On this foundation he situates three pillars which categorize the exploration of knowledge, its value assessment and its active management. This framework summarizes the main areas on which a KM initiative should focus.

A Model of Intellectual Capital (Edvinsson)

Leif Edvinsson of Skandia achieved notoriety in the field of Knowledge Management after being named the first CKO in 1991. He publicized his work within Skandia and later developed his thinking in a series of publications. The focus of Edvinsson's interest is intellectual capital management and the valuation of knowledge assets. His core model is a scheme for organizing a firm's assets, which defines four major components of intellectual capital and their interactions for value creation:

- Human capital relates to a firm's human resources, including the knowledge and know-how that can be converted to value. This is said to reside in people, organizational routines and procedures. Intellectual assets include codified, tangible or physical descriptions of specific knowledge to which the company can assert ownership rights and readily trade in disembodied form.
- Structural capital relates to the firm's supporting infrastructure. This is defined as both physical infrastructure (building, computers, etc.) and intangible infrastructure (history, culture, management)
- Business assets are defined as the structural capital which a firm uses to create value in its commercialization process (processing facilities, distribution networks)
- Intellectual property relates to the intellectual assets of the firm for which legal protection has

been obtained.

The dynamic aspect of this model relates to the creation of value, for which Edvinsson proposes there are two fundamental sources. The first are those innovations which are generated by the firm's human resources into legally-protected intellectual assets, and the second the products and services which result from the commercialization of innovations.

The Ecology of Knowledge Management (Snowden)

David Snowden, who directs the Cynefin, IBM's Centre for Organizational Complexity, has developed an approach to implementing Knowledge Management programs in a series of articles that rest, in general terms, on a foundation of cognitive science, semiotics and epistemological pragmatics. In these works, Snowden elaborates an action-oriented knowledge system that embraces four major elements:

- Explicit / Tacit knowledge
- Knowledge assets
- Trust
- The certainty / uncertainty of decisions relative to (a) objectives and (b) causal relations

These are developed, together with their interactions, in a system of thought that is focused on action: the value of knowledge, he writes, "*...comes from its exercise, not from its existence per se*" (1999: 4). This is woven together with a fabric that recognizes trust as a fundamental arbiter of knowledge dynamics, humans as the vessels of tacit knowledge, and external systems and structures as the holders of explicated knowledge. The approach to knowledge in organizational contexts is from a decision-making perspective, particularly with regard to the level of certainty pertaining to means, ends and causal relations.

Snowden argues that the first step is to map the stock of tacit and explicit knowledge in an organizational unit. Explicit knowledge thus identified and considered valuable is channeled into artifact-creating systems and structures (e.g., a knowledgebase). Tacit knowledge assets pose the conundrum of being more valuable but also more problematic, leading to the explication of tacit assets that can be readily articulated, and the creation of competence management systems for those that cannot.

A decision matrix provides a starting point for the judgment as to whether tacit knowledge assets should be explicated. This contrasts the, "*...uncertainty of objective ... with uncertainty of cause and effect. It provides four environments, each of which requires a different balance of tacit and explicit knowledge*" (1999,p4)

This decision matrix and the model suggest that organizations will manage four types of transitional activities:

- Sharing explicit knowledge through systems and structures;
- Sharing tacit knowledge through psychosocial mechanisms;
- Transforming tacit to explicit knowledge through BPR, documentation and related;
- Releasing tacit knowledge through trust and its dynamics

The balanced and adapted management of explicit and tacit knowledge is said to lead to Knowledge Management ecology within a firm.

Knowledge Management Processes (Inkpen & Dinur)

Andrew Inkpen and **Adva Dinur**, of Thunderbird and Temple University respectively, introduced an empirical model of Knowledge Management designed to explicate learning and knowledge transfer between partners in strategic alliances. They begin with the idea that, "...*the firm is a dynamic system of processes involving different types of knowledge*" (1998: 454) and go on to explore how firms acquire and manage new knowledge, particularly with respect to alliance arrangements.

The model they propose distinguishes between tacit and explicit knowledge and holds that a key challenge is the conversion of tacit individual knowledge to explicit organizational competence. They state that, "...*organizational knowledge creation should be viewed as a process whereby the knowledge held by individuals is amplified and internalized as part of an organization's knowledge base*" (1998: 456). Knowledge conversion, creation and learning occur in a multi-level context that invokes different processes depending on the level in play. At the individual level, interpretation and sense-making are key; at the group level, integration; and at the organizational level, integration and institutionalization.

Organizations therefore have, "...*a range of types of knowledge and carriers of knowledge*" (1998: 457) and the issue becomes understanding the importance of different types of knowledge specific to an organizational situation, and how organizations transform and manage this knowledge.

The vertical dimension of this model – tacitness – is a continuum that carries the assumption that the more tacit the knowledge, the more difficult it is to codify and transfer. The horizontal dimension straightforwardly distinguishes the different organizational levels at which knowledge may reside. This base model is joined by the notion of mechanisms and processes, either formal or informal, which are invoked to encourage or accomplish knowledge transfer. Forty two-partner joint ventures in the automotive industry formed the empirical context in which Inkpen and Dinur applied this model to investigate knowledge creation and transfer. Their results, which are significantly abridged for present purposes, outline the various ways in which different types of knowledge may be transferred and integrated across the organizational levels of a partner participating in an alliance.

Intellectual Capital Management (Van Buren)

Van Buren, a senior associate with the Research & Enterprise Solutions unit of the American Society for Training and Development (ASTD), has reported a model developed by the ASTD Effective Knowledge Management Working Group, a virtual organization composed of Knowledge Management practitioners in various industries. This group has created an intellectual capital management model whose goal — much akin to a benchmarking exercise — is a standard set of measures that can be used to assess Knowledge Management activities across different companies. The model includes two sets of measures:

- Those pertaining to intellectual capital stocks, including (a) human capital, (b) innovation capital, (c) process capital and (d) customer capital;
- Those pertaining to financial performance and business effectiveness.

The starting point resides in the firm's stock of intellectual capital, the identification of which serves as input for knowledge management processes and enablers (Figure 16). Despite their lack of visibility, these are held to constitute, "... the critical leverage points for enhancing the firm's Knowledge Management capability" (1999: 76). The critical Knowledge Management processes, which are imbedded in the firm's activities and initiatives, are held to be the (a) definition, (b) creation, (c) capture, (d) sharing and (e) use of knowledge. The enablers are, in brief, those corporate functions / systems /

structures, which define, leverage and structure the firm's activity: leadership, corporate culture, communication, technology processes, human resources policy and so on.

This therefore highlights the interaction of processes and enablers, all of which is placed in the context of a firm's business strategy: Knowledge Management efforts should be driven by strategic intent rather than the reverse.

Outputs are made as concrete as possible through measures associated with financial performance and changes in the stock of intellectual capital. Van Buren suggests a range of financial performance measures including market-to-book value, return on equity, revenue per employee and value added per employee. He suggests a total of 50 intellectual capital measures distributed across four categories — human capital, innovation capital, process capital and customer capital — and including such items as educational levels, time in training, the number of copyrights and trademarks, average age of patents, IT accesses per employee and annual sales per customer.

A Taxonomy of Knowledge Management (Despres & Chauvel)

The authors of this chapter launched its precursor as a research program which aimed to systematically review the various literatures associated with applied Knowledge Management and construct from these a classification that accounted for activities in the field. This review led us to conclude that the field is dominated by "islands of discourse" which are in various states of agreement. Based on this, we suggested that four dimensions cut across many of the discussions:

- Time: referring to a linear and simplified representation of cognitive process, including the (a) mapping, (b) acquisition, (c) codification, (d) storage, (e) application and (f) transformation of knowledge or its elements,
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- Type: referring to tacit and explicit knowledge
- Level: referring to different levels of social aggregation,
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- Context: referring sense-making, in that no knowledge element has any meaning outside of a given context.

We assembled these in a classification system which proports to situate actions in the field.

This approach allows one to situate both the Knowledge Management practices commonly employed by companies, and the products and services offered by vendors. After reviewing anecdotal and case evidence from this ensemble, we concluded that seven major clusters of activity are currently active in Knowledge Management:

- Business intelligence,
- Benchmarking,
- Datawarehousing,
- Groupeware/virtual teaming,
- Communities of Practice,
- Innovation/synergies, Creativity,
- Learning/Competencies/Employee Development

Our claim is that the majority of behaviors and practices associated with Knowledge Management may be located in this classification, which we liken to a "map" that permits the plotting and tracking of KM initiatives. We draw the practical implication that managers working in the field should realize that

Knowledge Management is more than groupware or an intranet (Group level / Package-Store & Share-Apply in the KM Map), more than business intelligence (Organization level / Scan-Map) and more than a yellow pages database of employee CVs (Individual level / Package-Store). This research indicates that most companies implement such projects on a small, experimental scale and then expand into other areas of the "map" which is itself a chart of the feasible options.

We have also made the point that while Knowledge Management has always been rooted in the individual and his or her behavior, the formalization of the field has shifted attention upwards in the Map towards systems and structures that encourage the generation, transfer, application and re-invention of knowledge in a company. Much of this shift has been occasioned by the information technologies that facilitate one-to-one, one-to-many, and many-to-many communication.

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