

## **ABI WhitePaper**

### **The Development & Application of Organizational Knowledge**

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Science and mathematics have nothing to say about intelligence, knowledge and wisdom. Nor do they formally distinguish the properties of data and information. This is because, once beyond data, the content of these categories have subjective components. So Shannon, the father of information (more accurately, communications) theory, went no further than the bit--which he described as the minimal unit of information required to reduce uncertainty. Machines can process data, keep track of relationships and attributes, and make logical (but not intuitive) inferences. But as far as we know, only certain biological systems are capable of knowledge. However, over the centuries much thought has been given to the meaning, properties and relationships of each of these terms by thinkers in a sub-discipline of philosophy called "epistemology."

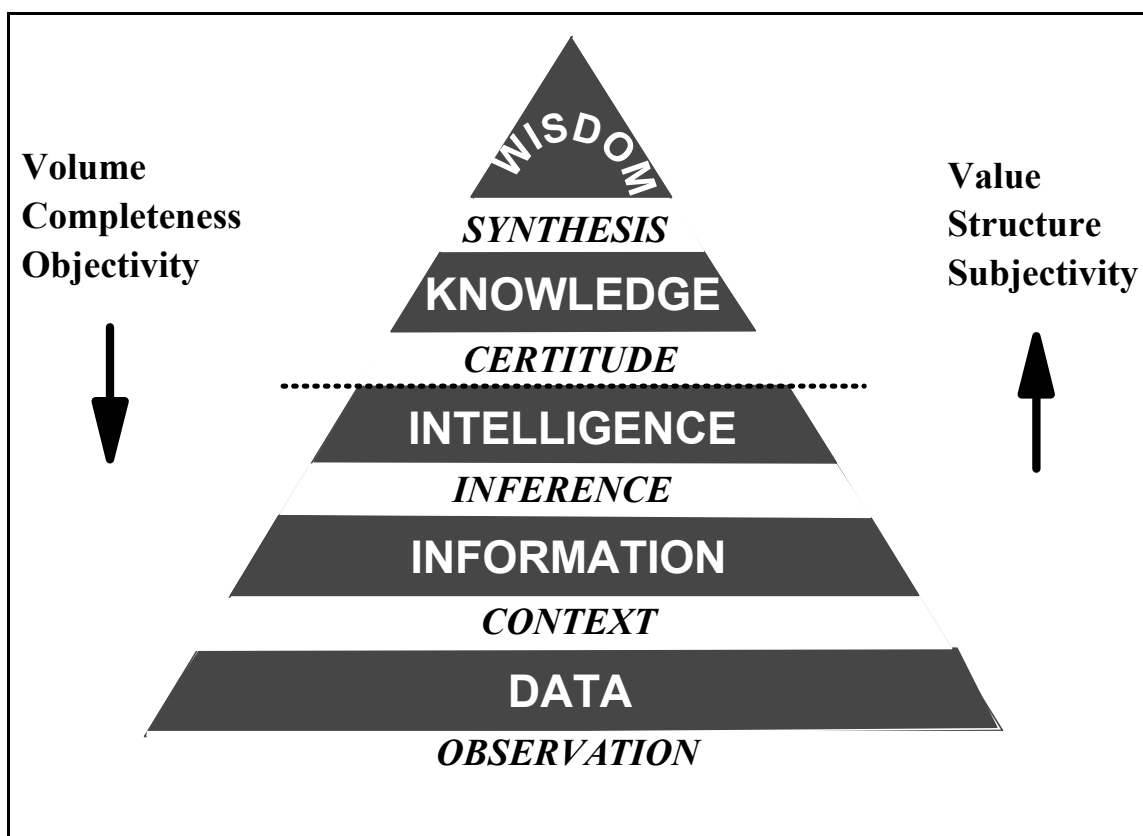
The concepts are slippery--in no small part because these words mean very different things in common parlance than they do to epistemologists. Not only do we often use "data," "information" and "knowledge" interchangeably, it is often the case that what is knowledge to one person is data to another and wisdom to a third.

The business rationale for digging into the authentic meaning of these words springs from the potential of organizational learning. To most people this means "the learnings of people in carrying out organizational functions." Unfortunately, if these people leave, their knowledge goes with them. But if that knowledge has been codified, it greatly enhances the ability of another set of people to acquire it. If we use "a change in collective mental models" as the definition of organizational learning, we can think of changes in the codification of those models as an essential requirement for institutional learning. (Some might say that when IBM changes its financial model, or pricing models, or order-to-cash process model, it has "learned"---but this seems truly far-fetched. It is like saying a computer has learned something when a programmer debugs a program that runs on it.) Codification of knowledge (as, for example, in an expert system) de-subjectivizes it, instantly transforming it into what epistemologists would call information. But precisely because it is objectified, it can become a tangible institutional asset, to be re-transformed into knowledge when other people come to understand it.

One other reason for getting as unambiguous as possible about the meaning of knowledge: Knowing what we are talking about would seem an absolutely minimal prerequisite for making any progress at all in improving the processes by which knowledge is created, codified and applied by organizations

The Figure below was developed in the early 1980's as a synthesis of many schools of epistemology that would provide clarity to the most salient distinctions between Data, Information, Intelligence, Knowledge, and Wisdom. In 1991, Barraba and Zaltman dubbed it "Haeckel's Hierarchy." [1]

### Haeckel's Hierarchy



- ^ Knowledge is subjective
- ^ People, not technologies, are the repositories of knowledge
- ^ Manage the transformations, not the states

**DATA**

**We create data by making observations.** The intellectual content of the data can vary from very little (e.g., the product code and price of each item "observed" by a supermarket's scanner as items pass the checkout counter) to very great (e.g. the laws of thermodynamics, copied from a textbook by a researcher preparing a list of scientific discoveries of the 19th century). It is data to the observer, even though it may be wisdom to the creator. Likewise, the charter and givens of an assignment are data to the assignee, as are any results from previous efforts to solve the problem; advice from colleagues; answers to questionnaires, etc. How long these remain data depends on the experience and familiarity of the observer with the intellectual content of what is observed.

Questions relating to the management of observation include:

1. Where should we place probes (customers, distributors, regulators, competitors, operations, etc.)
2. How often should we sample them?
3. Who should have access? Is there any reason for depriving anyone of access?
4. How systematic is the sensing process? How do we know we are capturing the data that is important? How can we maximize the probability that we capture data that WILL be important?
5. Who is accountable for changing what we sense in the environment and internally?
6. Have we identified the particular data needs of each major role in the organization?
7. What data should be captured for learning purposes?

**INFORMATION**

**Information is created by the application of context to data**, which produces meaning in the form of patterns that relate the data. This first stage of interpretation involves filtering the data with perceptions, concepts and models---each of which is an abstraction of selected entities, and certain of their attributes and relationships. These filters may pre-exist as personal knowledge or as codified financial, forecasting, pricing, procedural, etc. models that are used to interpret the observations made. Lists of rules, policies, criteria, and parameters are filters that can be used to establish the relevance or status of interpretations.

The meaning imputed to the data is a function of the filters used. For example, detectives will apply prior experiential knowledge, along with the tools of the trade, to find patterns in clues. Because their experiential filters are different, the patterns they see will be different. Each will have their own interpretation of what the data mean, and therefore their own store of information about what happened. And two computers using different data base designs can be repositories of the same data, but different information. Similarly, scientists using the same procedures to replicate an experiment from common data will have varied interpretations---even if they produce the same result and later agree on an identical formulation of the conclusion---because they have different personal filters.

Some of the critical issues for managers regarding the application of context are:

1. What institutional models/filters should be used, by role, to interpret the data? Who determines what they should be and when they should change?
2. Which individuals have personal filters and mental processes that cause them regularly to "mine" more information from the data?
3. Should data mining technology be used to find patterns in the data other than the existing data models provide? (Data models represent conscious predictions about what information will be useful.) Who makes these predictions, and how reliable are they?

## **INTELLIGENCE**

**Intelligence**, in the CIA sense of the word, **is produced by the application of inference to information**. It is the second stage of interpretation. The analyst at the Iraq Desk, for example, draws conclusions from patterns provided by satellite photos, export/import information, agents' reports, etc., to draw conclusions about the health of Iraq's economy. In fact, several alternative analyses may be prepared---each a different interpretation of what the information means. The inferencing process may be logical or intuitive, conscious or subconscious. It is not only intelligence and experience, but talent that distinguishes good analysts.

Managerial issues relating to inferencing include:

1. How non-linear is the behavior of the phenomena observed? The answer will indicate the relative importance of intuition and logic as inferencing methods. Very linear systems are good candidates for automation. Very non-linear systems can only be simulated.
2. How segregated should analyses be? The more compartmentalized the analyses, the more difficult it becomes for any given analyst to see the "big picture." There is a trade-off of security and integration involved in this choice.

**KNOWLEDGE**

**Conviction that we KNOW something requires a requisite threshold of certitude.** We can derive this from formal proof, personal experience, the reputation of someone asserting something or any combination of logical, intuitive, and emotional processes

Knowledge can be used to filter data to arrive at meaning, from which we form interpretations. In this case, knowledge is a context that we accept with certitude. Knowledge is, however, *subjective*, and resides in humans, not in databases or books. A so-called "expert" or "knowledge-based" system codifies as rules the knowledge of experts. But neither the storage device nor the symbolic representation of the rules can be said to "know" what the rules mean. To another human scanning the rules, they are at first mere observations. But if that individual internalizes them, and accepts their validity, then he/she can be said to "know" them.

Because newly created knowledge represents a new mental model, or some kind of modification of existing models, its formation constitutes learning. A process of achieving knowledge is a "learning process."

"Knowing the facts, knowing the model, knowing the algorithm, knowing the conclusion" are another type of knowledge: knowing ABOUT something, but not necessarily implying belief in their validity, only in their existence and possibly their attributes. Similarly, we say we know THAT, or we know WHY, or IF, or HOW, or WHO, or WHEN or WHERE. Each of these kinds of knowledge are built from (however limited or irrational) observations, contexts, inferencing and certitude.

Some questions pertaining to the management of certitude include:

1. Do decision-makers approve conclusions reached by others, or do they reach the conclusions themselves? In the first instance, do they approve of approach to be taken in advance?; in the second case, do they have a systematic decision-making and evaluation process?
2. How does a team of decision-makers establish collective certitude about a course of action?
3. How is certitude about a given choice passed from incumbent to successor?

**WISDOM**

**Wisdom is formed when multiple areas of knowledge are synthesized** into an over-arching framework of thought. This entails integration of the contexts, inferences and convictions associated with each chunk of knowledge. An organizational analog is an "enterprise model" that expresses the purpose and boundaries of organizational behavior; the way multiple subordinate organizational capabilities and codified knowledge repositories are linked; and the way information flows to support that linkage.

Questions relating to the integration of domains of capability into organizational capability include:

1. Is the organization viewed as a system, or as isolated islands of activity?
2. Are linkages specified as activity flows and/or as accountability flows?
3. How dynamical is the system? Is the wisdom that integrates its behavior static or dynamic?

**INSIGHTS**

Any serious attempt to "manage knowledge"---as opposed to information--- must come to grips with its subjective component. The fact that one person's knowledge may be another's wisdom and a third party's data sheds light on a requirement for effective collaboration: to create collective knowledge in a group of people, it is necessary that their subjective assessments be as common as possible. This, in turn, suggests that it would be highly desirable for them to collectively experience the transforms between stages of the hierarchy, and that their progress be codified as shared information about their shared observations, context, inferences and convictions.

Decision-making processes are the organizational mechanisms by which knowledge is transformed into action. They can be thought of as structured ways of navigating around the hierarchy. Human mental states are progressing through it constantly, recursively, and at many levels. When knowledge is acquired, learning has occurred, and the process by which it is obtained is "learning." Although knowledge acquisition is not a serial, or linear process, it is possible to identify plateaus in a *decision-making process* that correspond to levels in the hierarchy.

**A COLLABORATIVE DECISION PROCESS: GM'S DIALOG DECISION PROCESS**

The Dialog Decision Process and its application to more than 150 asset allocation decisions at General Motors, is described in Vince Barabba's book *Meeting of the Minds* (Harvard Business School Press, 1995). It is a systematic process, grounded in decision and risk theory, for taking a team of decision makers through a shared experience whose end is a shared conviction about the best way to allocate resources.

Two teams are involved: the resource allocators and the people who present them with "starter sets" of context, conclusions, and synthesis. Each phase of the process involves collaborative generation and buy-in by the decision makers to a shared representation of:

- ^ the way the decision is framed,
- ^ the alternatives worth pursuing,
- ^ the value of each alternative, and
- ^ a hybrid decision that combines elements from each alternative to create more value than any of them.

When the decision-makers have allocated resources in accordance with the conviction they have jointly reached about the best way to do that, they have both created collective knowledge and translated it into action.

**EXECUTING DECISIONS FAITHFULLY: THE COMMITMENT MANAGEMENT  
PROTOCOL AND AUTHENTIC DIALOG**

Allocating resources involves assigning them to individuals who are made accountable for applying them to produce the outcomes specified by the decision. A universal and general protocol for assigning, negotiating, performing and assessing accountabilities has been developed that can be used to ensure consistency of execution and intent--i.e. organizational integrity. But though the existence of such a protocol is necessary, it is not sufficient. Successful use of it requires authentic dialog between the assignors and recipients of accountability. "Authentic" dialog means that each party says what they mean, and mean what they say. For reasons that Chris Argyris has reported on for over four decades, this is often not the case in business organizations, which have systematically fostered modes of communication that defeat authenticity. In Argyris' terminology, the difference between "left column" (what I say) and "right column" (what I mean) is the measure of authenticity.

Authenticity is a pre-requisite for establishing trust, by which is meant "the certitude a person or group has about the intent and competence of another person or group." So we come back to knowledge---in this case, the knowledge that one can trust a prospective collaborator.

**INTEGRATING KNOWLEDGE DEVELOPMENT AND APPLICATION INTO A N  
ADAPTIVE SYSTEM**

All successfully adapting systems iterate through a Sense-Interpret-Decide-Act cycle, applying the learnings from previous cycles to improve performance in the next cycle. Institutionalizing adaptiveness requires managing:

- ^ The development and codification of information and knowledge
- ^ The development and codification of procedures (descriptions of the steps necessary to transform specified inputs into specified outputs)
- ^ The specification, negotiation, codification, execution and assessment of accountabilities for producing the outcomes required by the business

Enterprise models should codify the design that integrates these three elements. To date, they have neglected the third, because a sufficiently rigorous way of codifying accountabilities for producing outcomes with *ad hoc* processes (required when applicable procedures are non-existent or only partial) has been lacking.

**FROM OBSERVATIONS TO ACTION---SYSTEMATICALLY AND ADAPTIVELY**

For large, complex organizations, successful adaptation requires cycling through the adaptive loop at several levels simultaneously and in a dynamic, but coordinated way. If the components of the system are "empowered," this coordination requires a common context, and a system-level design for dynamically dispatching resources to produce the outcomes required. A rigorous commitment management protocol, executed with authentic dialog, can be used to link resource allocation decisions to action.

Each key role (that is, a role accountable for producing a "mission-critical" outcome) must navigate the hierarchy to create the conviction required to make the resource allocation decisions, and then transform them into action by negotiating coordinated commitments. Each role should therefore be supported by a role-specific set of signals, models, decision-making and commitment management processes.

In more static, predictable periods, when cycle times measured in years were adequate, a functional hierarchy, operating as closed-loop mechanism under a command-and control management system was properly the business model of choice. Knowledge development was heavily skewed toward designing and learning how to execute procedures. But in fast-paced, unpredictable environments, the strategic imperative changes from make-and-sell efficiently to sense-and-respond adaptively. Knowledge development is therefore skewed toward supporting unprecedented responses to unanticipated requests by people accountable for producing outcomes, rather than executing procedures.

**A MULTI-LEVEL ADAPTIVE LOOP FOR INSTITUTIONALIZING LEARNING**

The Sense-and-Respond model describes a systematic way of using technology to support a role-specific information support design to augment the adaptive process of capturing the inputs, outputs, operational results and environmental changes associated with a category of decisions; interpreting them; and deciding whether to change the process for making that type of decision next time around. Thus, the synthesized wisdom of the previous cycle becomes a set of observations for successive cycles. By assigning accountability for sensing and interpreting when what is sensed and how it is interpreted must change, an organization can systematically and explicitly make decisions to change its understanding of the world, and link that new understanding into coordinated accountabilities for adapting to that new understanding.

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**ENDNOTES**

[1] Barabba, V.P., and G. Zaltman, *Hearing the Voice of the Market: Competitive Advantage Through Creative Use of Market Information*. Boston: Harvard Business School Press, 1991. Another discussion of "Haeckel's Hierarchy" can be found in Haeckel, S.H., and R.L. Nolan, "The Role of Technology In an Information Age: Transforming Symbols Into Action," Chapter in *The Knowledge Economy: The Nature of Information in the 21st Century*, *Annual Review of The Institute For Information Studies*, 1993-1994, Northern Telcom Inc., and The Aspen Institute, November, 1993.