

Data, Information, and Knowledge - Relevance and Understanding

Abstract

It ain't what we don't know that hurts us, it's what we know that ain't so."¹

"We also study Cisco. What comes through from our class discussion is that Cisco thought they knew it all and had no need for corroboration. The conflicting data was available; they chose not to look at it."²

"I have no data yet. It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts."³

Here we have three of several issues associated with data, information, and knowledge.

1. Data that does not represent truth.
2. Hubris of thinking we know all we need to know.
3. Succumbing to the temptation to make a decision before the relevant data is in.

This note takes up a general set of considerations regarding data management.

¹ Mark Twain

² James Drogan, "Lean SCM vs the Crisis," e-mail to David Livingston et. al., May 19, 2009

³ (Doyle)

Data, Information, and Knowledge

Data, information, and knowledge are not identical.⁴

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11. Information Management and Technology

The difference between data, information and knowledge

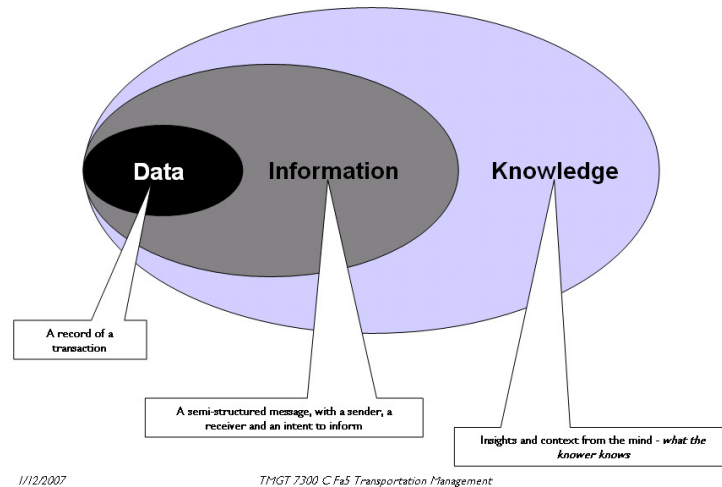


Figure 1 The Difference Between Data, Information and Knowledge

Some points:

1. Data is a prerequisite for information and information is a prerequisite for knowledge. This places a premium on the correctness of the data. Data are attributes of objects (e.g., age of a person, location of a shipment).
2. The cost of acquisition of data and subsequent development of information and knowledge increases as one moves from the left to the right in Figure 1.
3. The value of decisions made on the basis of data, information, and knowledge increases as one moves from the left to the right in Figure 1.
4. Human involvement in an information system increases as one moves from left to the right in Figure 1.
5. The skills and experience required of the human to be an effective participant in an information system increases as one moves from left to the right in Figure 1. The apprentices are to the left, the adepts to right.

Relevance

Consider the following sequence.⁵

1. What business decisions must be made and why? Here we are seeking to write declarative sentences that look something like "We need to make a decision about ... because it will affect how we ..." These need to be decisions of significance to the firm.

⁴ (Drogan 2006)

⁵ (Drogan 2005a)

2. How will these decisions be made and why? By how I mean the general approach to making the decision. For example, a decision on which container to move next will be based upon a) the value of the goods to the shipper and 2) the value of the shipper to the organization. It's useful to also write declarative sentences to help answer these questions.
3. What data is required and what will be its source?

Relevance is a measure of the ability of the data, information, and knowledge to support the process for making decisions.

1. Is there a strong relationship between the data, information, and knowledge and the process for making the decision?
2. Is the data, information, and knowledge available within the decision window?

The Decision Window

A few words are in order regarding the decision window.⁶

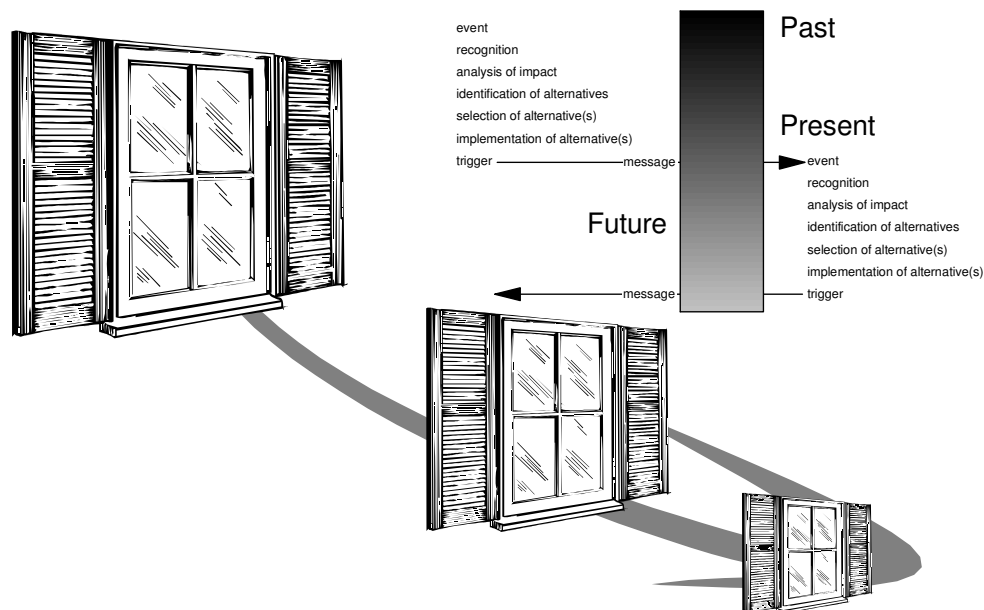


Figure 2 Decision Window

The decision window is opened by the initial event and closed by the resulting outcome. Any intervention to change the outcome must come within this window. The windows continue to grow smaller due, I think, to the ubiquitous of data, information, and knowledge; pervasive global communications (always on, always connected, always transacting⁷); the speed at which business is conducted; and, last but not least, the embracing of risk and uncertainty as representing opportunities for competitive success.

I include here a portion of the contents of an e-mail exchange on this subject which may shed additional light on my thinking.⁸ The original material is in *italics*. I have added additional explanations into the original e-mail in regular typeface.

⁶ (Drogan 1999a)

⁷ (Drogan 2003)

⁸ J. Drogan to D. Livingston, RE: Homer, Great Books and Modern Life, e-mail, December 28, 2006

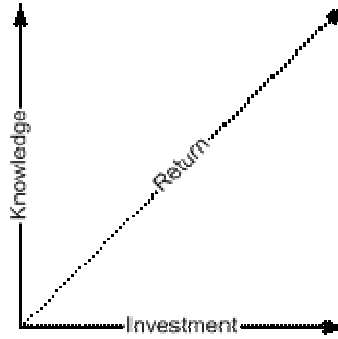


Figure 3 Investment in Developing Knowledge

In this case I'm suggesting that an investment in time/effort results in the acquisition of knowledge and a subsequent return on the investment through the actions predicated on that knowledge.

The greater the investment, the greater the knowledge acquired, and the greater is the expectation for return.

The return line is anchored at the origin and rotates counterclockwise or clockwise depending upon one's capacity (greater or lesser, respectively) to absorb and internalize the knowledge. The length of the line is a function of the commitment one makes to the investment. Lifetime learning is represented by long lines.

One could, I suppose draw, at worst, a horizontal line indicating the level of knowledge required to resolve certain issues. At best, I suspect this line probably rises as one goes from left to right. The three box model for describing a supply chain was satisfactory at one time, but the five box model is to be preferred, and someone has had had the temerity to suggest five is not enough.⁹

The investment line suggests that there is a limit (one cannot invest an infinite amount for an indefinite time) to the amount of investment that one is willing (boredom arrives) or able (the decision window has closed; investment is no longer available) to make.

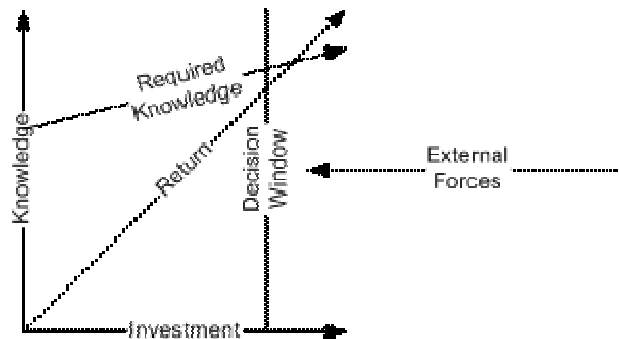


Figure 4 Required Knowledge and the Decision Window

In the second case, external forces are tending to push the limit set by the decision window to the left. Unless one changes the return line one will, over time, have less and less knowledge available to resolve increasingly complex issues. I think the decrease in the size of decision windows is an unstoppable force. The only thing that one can do to cope is to rotate the return line counterclockwise.

Hence, what we need is to find a way to rotate the return line counterclockwise. I understand the line may shorten (an implication to be worked through later).

⁹ The three box and five box models are supply chain descriptions. I have suggested that the five box model is insufficient.

I see only two ways to do this. Improving the K-12 educational system, at a minimum, but also extending this to improvement into higher education (at least to the Masters level). We have discussed this at some length.

The second way is to improve collaboration. Technology helps here, but there is also a change in mind set required. My experience is that you can dump a lot of pretty smart people into the SIDAL [Sense, Interpret, Decide, Act, Learn] process, but they will not necessarily form a high performance team.¹⁰ The notion of collaboration ought to be on our discussion list.

Oops, a third way pops up. Increase the return by focusing only on relevant knowledge. That, of course, is what fact-based hypothesis-driven reasoning is all about. And this calls into question the value of the Great Books (this alone ought to provoke some sort of response from you). Eruditeness may, in fact, be a burden in the future world. On the other hand, those that traffic in imagination, to whom you refer in the last part of your note, may be of great value.

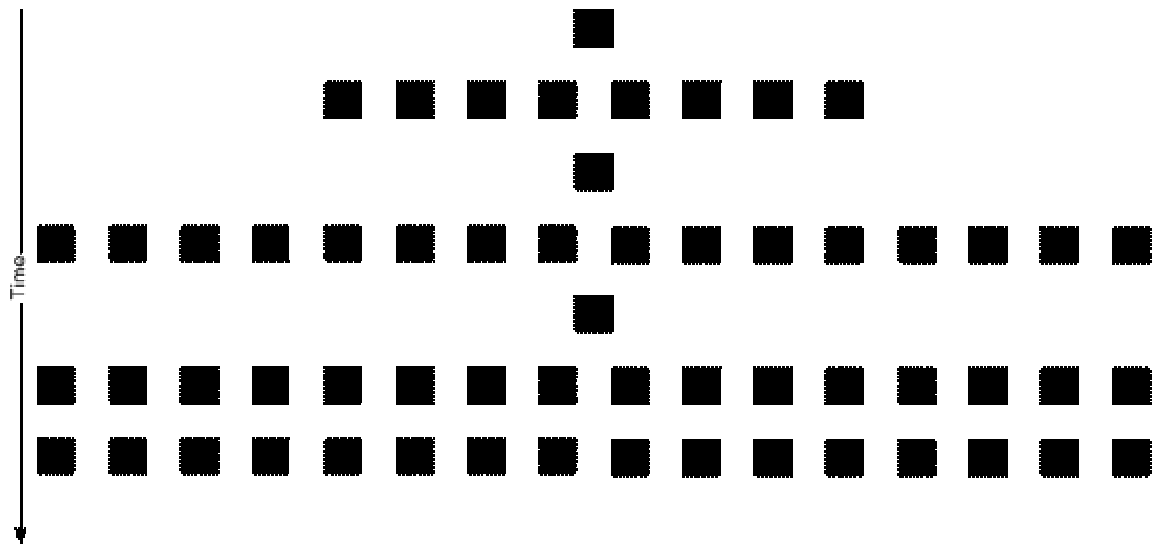
As to the matter of boredom, the option here is to find a way to make the seemingly boring actually exciting. That's what good teachers are all about. I think we can agree we have too few of these.

However, I think there is and will always be the need for the person that understands the picture to be made from all the little pieces. Where are they to be found? How are they to be nurtured and retained?

Maybe Homer and Great Books do not fit with Modern Life. This may be seen as in opposition to what I have often maintained prior to this note. Indeed, I think it may well be. If Homer and the Great Books can be considered as representative of the knowledge of the person that understands the picture to be made from all the little pieces, then I [sic] what I am leading towards [is] this person as the composer, orchestrator, and maestro (COM; acronym is required because I sense I'm going to come back to this idea). We need more of these.

And we need the members of the orchestra, the specialists, for which Homer and the Great Books are not what is required.

Now the following should come as no great surprise.



Over time, as technology and our understanding of collaboration has developed, the COM (the single box) can direct an increasing number of specialists. Collaboration is not represented, in my mind, by blogger babble, but rather by such things as open source and Wikipedia. The COMs must understand and must apply Homer and Great Books while the specialists should be content with the Red Books (IBMese).¹¹

¹⁰ (Hackman 2002)

¹¹ By Red Books I meant specific, detailed expertise.

What seems so straightforward, blissful even, is set upon by culture, Maslow's Hierarchy, myopia, and all the related diseases that hinder our ability to pay attention, to listen and hear, to understand, to practice tolerance, to accept and, ultimately, to work in a more positive way for the common good. There are, as you have often pointed out, cures for the diseases if only the patients will be willing to take the waters

So there you are. It's all about incentive. Unfortunately, incentive generally arrives when one is under duress (think IBM in the early 90s). In the pace of today's and tomorrow's world that may well be too late. It becomes harder and harder to get on top and stay on top of the wave. I'm pretty sure that we in higher education are not dealing with this as effectively as we ought.

All this does not, in my mind, obsolete SIDAL.

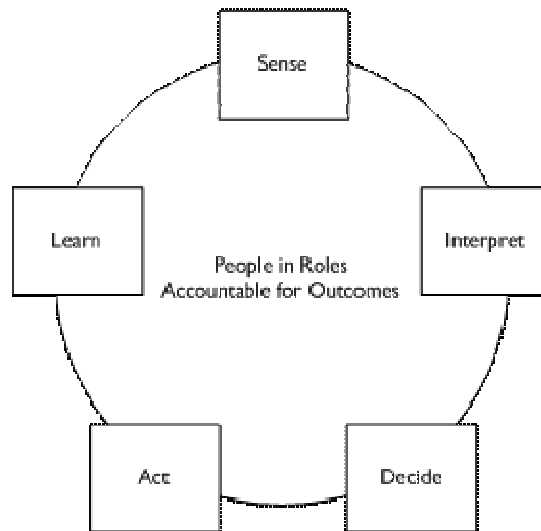


Figure 5 The SIDAL Loop

It does suggest to me that we ought to moving towards structures characterized by a (large) number of small, fast SIDAL cycles operating in a collaborative, associative manner (much like the brain?), all under the direction of COM.

I think I can see this and how it would work. Doubtless there are existing examples of this construct. The critical issue is getting from here to there. I think this requires significant behavioral change on the part of a significant number of people. Ah, yes, there we have that word again – change.

The argument here is our notion of relevance of data, information, and knowledge may very well be changing. That is, for the reasons given above, we may need to accept less relevance (accuracy, precision, relationship to need, timeliness or completeness) because we must act before the decision window closes. Our decision processes may require more collaboration because of the breadth and depth of the relevant data, information, and knowledge.¹²

¹² Drogan's First Law: Know what you know, know what you don't know, and know who knows what you don't know.

Finding the Knowledge Kernel

By “knowledge kernel” I mean the set of most appropriate data, information, and knowledge.

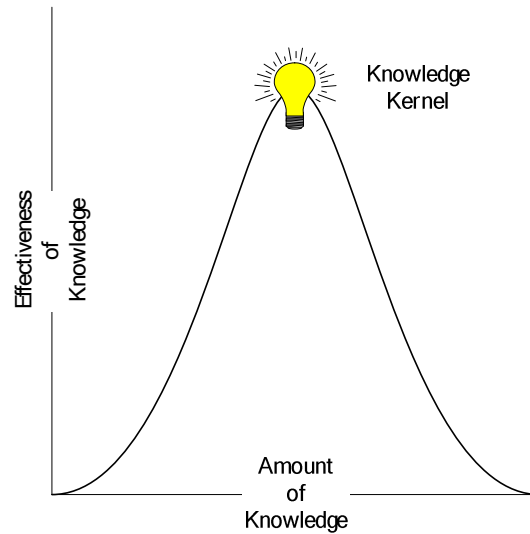


Figure 6 The Amount and Effectiveness of Knowledge of Technology

Figure 6 captures this notion. To the left of the mean lie the less qualified, to the right the over qualified. Subject to certain forces (e.g., planning and control levels, function responsibilities, to be discussed below, and time) the knowledge kernel changes. In a sense, what got us here will not keep us here.

The required knowledge kernel (used hereinafter to mean data, information, and knowledge) is defined by breadth, depth, and currency.¹³

¹³ This section is taken from (Drogan 2009)

Breadth, Depth, and Currency

The level of knowledge one requires is commensurate with one's role and responsibility in the organization. One determinant of role and responsibility is the planning and control level.¹⁴

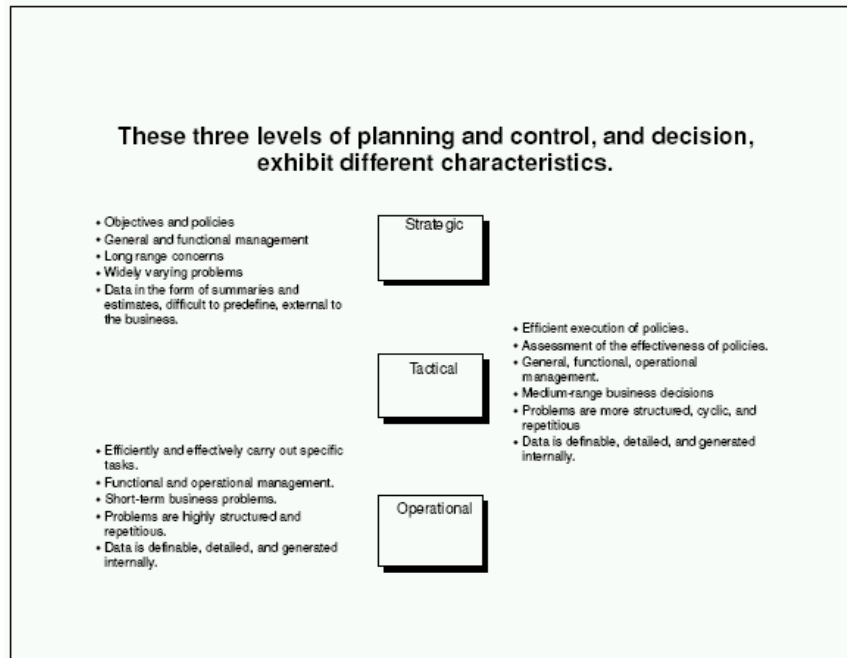


Figure 7 Planning and Control Levels

Towards the top of this chart one is interested in knowledge in support of competitive advantage. Senior executives are concerned about the health of the entire organization and, therefore, need a broad set of knowledge.

Towards the bottom of this chart one is interested in knowledge that leads to the desired return. In most organizations, people at the lower level of planning and control have narrower knowledge needs (see the following table¹⁵) and therefore take a narrower view of this matter.

Accounting and Finance
Administration
Executive
Intermodal
Maintenance and Engineering
Marketing
Sales
Transportation

Table 1 Functional Areas

¹⁴ (Drogan 2008)

¹⁵ (Drogan 2008). The functions listed here are based on those one might find in a freight railway.

Personnel in the transportation function may be concerned about GPS to enable real-time tracking of the firm's assets. This is likely not to be a concern of accounting and finance. Accounting and finance will, however, be concerned with the nature of investment required for this capability.

Together, Figure 7 Planning and Control Levels and Table I Functional Areas also helps us deal with the question of currency.

By currency, I mean how up-to-date the knowledge is. Data that is one second old may be more current than data that is one hour old, but may also be less relevant.

At the strategic planning and control level knowledge does not to be as current as at the operational level.

The currency characteristic is also shaped by the functional area. For example, changes in the knowledge that affects administration are likely to be less frequent than those affecting transportation.

Simply put, then, what one needs to know depends on where one sits in the organization.

Knowledge arriving after the decision window has closed may not only be useless, but have an unacceptable opportunity cost.

It becomes incumbent on us, after defining the required "knowledge kernel," to determine the actions we need to undertake to keep the kernel current.¹⁶

Keeping current ought to be a regular task in your day. Get the process organized and scheduled.

¹⁶ As an example, almost every day I scan some 65 RSS feeds, nine websites, two e-mail accounts, and three social networking sites. In addition I meet on a regular basis with my colleagues at the college and three external groups, scan and/or read two daily newspapers, one weekly news magazine, a number of less frequently published trade, business, and political journals, and am actively reading as many as four books. Keeping current is a lot of work.

It's Not that Simple

Were it that simple we could sit in our offices, ask questions, and come to a conclusion as to the breadth, depth, and currency of knowledge required by our job. However, other forces come into play.

For example, culture shapes what one needs to consider regarding the knowledge kernel.¹⁷

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Notes on Building a Management System

Project GLOBE provokes us to understand how cultural differences affect what we do as a business

<i>Dimensions of Culture</i>	<i>Cultural Groups</i>
• Assertiveness	• Anglo
• Future Orientation	• Arab
• Gender Differentiation	• Confucian
• Uncertainty Avoidance	• East Europe
• Power Distance	• Germanic
• In-Group Collectivism	• Indigenous Africa
• Performance Orientation	• Latin America
• Humane Orientation	• Latin Europe
	• Nordic
	• South Asia

Project GLOBE http://www.ucalgary.ca/rmg/GLOBE/Public/Link/lessons_project_globe.pdf

11/02/2005

TMGT 73.00 Transportation Management

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Figure 8 Consideration of Culture

What knowledge can one get to operate successfully in a culture that exhibits significant power distance?¹⁸

¹⁷ (Javidan and House 2001)

¹⁸ "Power Distance is defined as the degree to which members of a society expect power to be unequally shared. It represents the extent to which a community maintains inequality amongst its members by stratification of individuals and groups with respect to power, authority prestige, status, wealth, and material possessions. It also reflects the establishment and maintenance of dominance and control of the less powerful by the more powerful." (Javidan and House 2001)

The knowledge kernel is shaped by industry and company size. To stretch the point to make the point one might reasonably conclude that the knowledge kernel required to be a hair dresser is simple, in a Snowden sense, whereas that required to lead a global team exploring for oil is complicated.

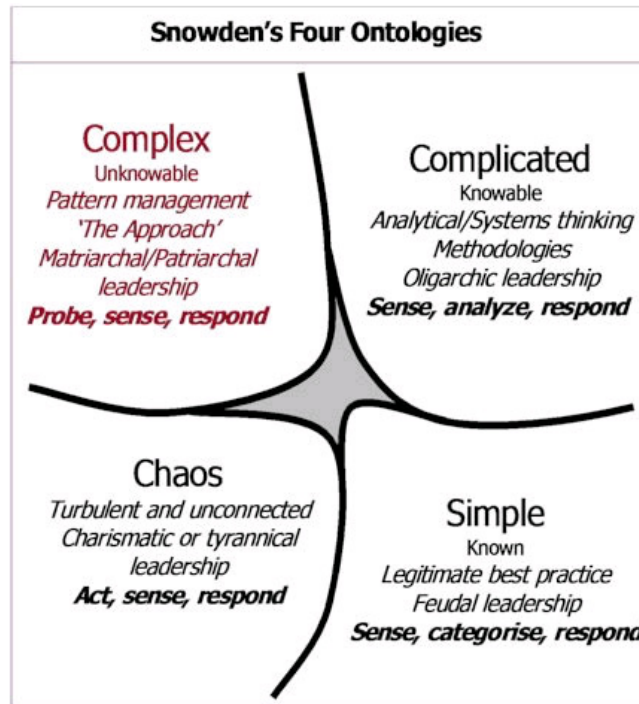


Figure 9 Snowden's Four Ontologies¹⁹

It seems reasonable to me, then, that the tasks of discovering and keeping current the knowledge kernel is very much a function of the industry and company size.

Corroboration

Cor·rob·o·ra·tion

n.

[Cf. *F. corroboration.*]

1. *The act of corroborating, strengthening, or confirming; addition of strength; confirmation; as, the corroboration of an argument, or of information.*

2. *That which corroborates.*²⁰

No longer can we simply accept what we see and hear at face value. Confirmation of the facts is becoming increasingly important. But confirmation takes time and I have previously argued that time is an increasingly critical resource.

“I believe that we’re about to witness what may turn out to be the last competitive frontier business will see. It’s going to be a war over the one priceless resource. Time. And when it comes, trust may turn out to be the best investment anyone’s made.”²¹

¹⁹ <http://blogs.salon.com/0002007/images/ontologies.jpg> [September 1, 2009]

²⁰ *Webster 1913 Dictionary*. Patrick J. Cassidy, 1913. Answers.com 14 Jan. 2007. <http://www.answers.com/topic/corroboration>

²¹ Jim Kelly, CEO of UPS, Remarks to the Commonwealth Club of San Francisco & Oakland Chamber of Commerce, February 23, 2000.

Can one trade collaboration for trust and thereby better cope with the relentless move of the decision window line to the left in Figure 4 Required Knowledge and the Decision Window on page 4? And if one can't, what is the alternative for coping?

Understanding

One of my students wrote:

“One must be cognizant of words being used as some words have multiple meanings and understand which one is being used or to use. Some words carry a different meaning between different countries. For example: My office in the U.S. refers to the word demurrage free-time and detention free-time as terminal free-time and equipment free-time, respectively. In the Callao, Peru office, they refer to demurrage free-time and detention free-time as equipment free-time and detention free-time, respectively.”²²

This brings me to principles of communication.

1. The grammar and syntax of the messages being exchanged are understood.
2. The information communicated in the messages is relevant.
3. The medium of communication is acceptable.
4. There is a desire to communicate.
5. There is confirmation of understanding.

The data, information, and knowledge required to make decisions has its roots in communication. Language and culture become major hurdles to assuring that the parties communicating have a common understanding of the data, information, and knowledge.

I don't think you can be comfortable with judging relevance in the absence of understanding. Further to this point, while researching for this note, I uncovered the following.

Summary

*Relevancy assumes a critical importance in control system operation because of the large amount of information available. The information deluge impacts the following areas: If information is presented at too high a rate or in too large blocks, the operators may not comprehend it. If useless data is often presented in a given display, the operators may ignore all data presented by that display. If the context of the data is not presented, the data may be meaningless to the operators. If the control and display systems are not properly designed, peaks in the message generation rate may choke the system. This paper describes the techniques in use and under development at the Clinton P. Anderson Meson Physics Facility for increasing the relevance of data both for real-time operations and for long-term analysis of accelerator performance. Data sifting and organization for presentation and for compact storage is discussed.*²³

The message here is to be heeded.

Management

Implicit in any discussion of relevance and understanding is that an underlying management system for data, information, and knowledge exists.

The argument I am advancing is that one needs a “knowledge kernel” and it is the management system that defines and maintains the value of this kernel. Caution here. In the modern world it's very easy to

²² J. Kou, TMGT 7200.1 Written Assignment, January 11, 2007

²³ (Swain 1975)

prefix the phrase “management system” with words like data, information, and knowledge. From there it is but an easy step to get into a discussion of supporting information technology (e.g., RAD arrays, SQL).

My experience suggests that the most important decisions regarding knowledge are made by the business. The role of information technology is to support the implementation of those decisions.

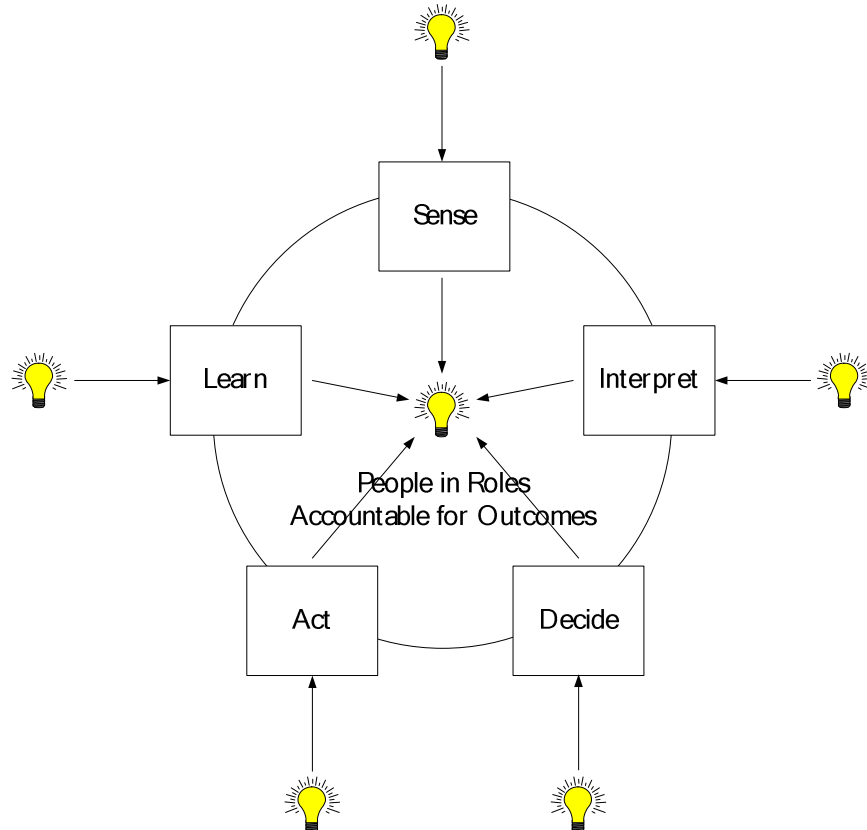


Figure 10 The Interplay Between SIDAL and Knowledge Kernels

Our ability to manage a business, represented by the SIDAL loop in Figure 10, is informed by the knowledge kernels shown to the outside of the loop. Execution of the loop should enhance the value of these knowledge kernels, represented by the single kernel in the middle of the figure. If we do this well these arrows represent virtuous loops that improve the effectiveness and efficiency of our business system.

Coda

What is critical in the context of the role and responsibilities of senior executives, and the decisions they make, is knowledge.

The notion of breadth, depth, currency, and application is summed up in this figure.

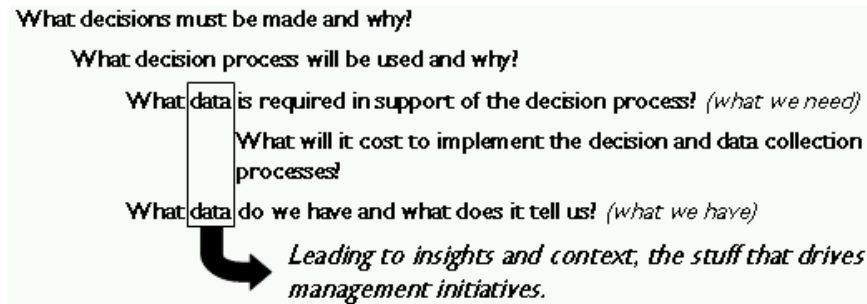


Figure 11 Determination²⁴

Figure 11 is process whereby one determines what data is required to support decisions. You do not want to collect data unless you know what it is to be used for.

This note has described an approach to defining the all-important knowledge kernel and an approach to applying that kernel to improve the performance of an organization.

I have not aimed at being prescriptive, but rather at being illustrative. My sense is that as your role and responsibilities change to be more encompassing of the goals and objectives of a firm you must take additional responsibility for managing the value of the knowledge kernel. Of course you may have a staff to help you, but at the end of the day, you are the one holding the authority and will be held accountable for the results. The excuse that your staff did not perform is unlikely to be looked upon favorably.

James Drogan
September 1, 2009

²⁴ (Drogan 1999b)

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