Journal of International Information Management

Volume 10 | Issue 2 Article 5

2001

Managerial information, the basics

Floyd J. Brock
Naval Postgraduate School

Gurpreet S. Dhillon
University of Nevada

Managerial information, the basics

Floyd J. Brock, Naval Postgraduate School, Monterey, California
Gurpreet S. Dhillon, University of Nevada, Las Vegas

ABSTRACT

A problem exists in the definition of information, particularly in its application in management. The problem emerges from the inability of academics and practitioners alike to differentiate adequately between data and information. Our failure to comprehend the concept of information casts doubt on the efficacy of analyses and development of information systems. As evidenced in the literature and surveys, this paper presents a collection of differing emphases in definitions of information. It then sifts for the basics and proposes a definition of managerial information.

INTRODUCTION

Information has many definitions. Shannon and Weaver's definition of information (1949) dealt strictly with communications and stands apart from our present day definitions. Their definition excluded any musing about meaning (Norretranders, 1998). Today information is " . . . whatever"; it is without a "generally accepted scientific description" (Devin, 1999). Information is without a single definition that is useable in commerce, academia, or government. Moreover, tomorrow perhaps, information will be just images and tales (Jensen, 1999).

Given the many definitions of information in textbooks and in other sources, the purpose of this paper is to propose a short working definition of **managerial information.** Understanding the concept of information is important because the efficacy of a number of activities in this current information age is based on a common understanding of the definition. Managers often create new meanings of information because different definitions will justify new ventures, careers, training, and allocations. Drucker's admonition of Management Information Systems, pointing to a need to focus on the meaning and purpose of information (1999), spotlights the different definitions. Perhaps, those who work with information have lost sight of a guiding definition for information, a touchstone. Information is so important, if we know what it is because our interaction with information is the impetus for change (Burke, 1996). Yet, "we're drowning in information and starving for knowledge" Rodgers, 1985). With an emphasis on management, the rest of this paper discusses the problem of having many definitions of information, results of a survey for definition, another way of considering information, and a proposed definition of managerial information.

THE DEFINITION PROBLEM

Questions about the definition information result in a plethora of answers from managers. Inquiry of this type is similar to randomly asking for the time of day from oncoming pedestrians. Often your question goes unanswered, but you usually get a different answer by every one. Similarly, information has a range of definitions. For example:

> "Processed data - . . . organized, interpreted and possibly formatted, filtered, analyzed, and summarized. [With data being defined] . . . as fundamental facts, figures, observations, and measurement, without context or organization" (Gordon & Gordon, 1999);
>
> or,
>
> "[Data] endowed with relevance and purpose" (Drucker, 1988);
>
> or,
>
> "Essentially, anything that can be digitized -- encoded as a stream of bits" (Shapiro & Varian, 1999).

Standing alone, each of these definitions provides a confined perspective and each has a deficiency. In the first example, processing without an objective quite often extrudes more data, only its form changes. In the second example, "relevance and purpose" sounds similar to a catechetical instruction, an initiation wish, or an article of faith. Using the last example, anything, which includes undesired noise, can be digitized; noise is not equivalent to information. These are representative of the many definitions found in the literature and listed in Tables 1, 2, and 3. The lists are extensive. Information is defined in too many ways to be conceptualized, leaving analysis and design without direction, and management without anything tangible. The lists reveal the definitional haze; they are better, however, than being given, "42," the answer to everything (Adams, 1989). Starting with the definitions of twelve authors listed in Table 1, many processes or methods (underlined) work on data.

Table 2 reveals 18 aspects of information that we should consider in the concept called information. These aspects appear to imply a human mental processor. In addition, reaching back to the attributes of information, data does not stand alone. It is in a supporting milieu. This context includes the history of the informational message, what was discarded en route, its correspondence with the physical environment and concurrence with certain events, and agreed to conventions and measurements (Norretranders, 1999).

Table 3 shows additional functional aspects and attributes of information. Two measures, reach and richness (content, accuracy, timeliness, and relevance), are now used as a value function for Information Superiority (DOD, 2001) by the Department of Defense (Evans & Wurster, 1997).

The three tables showing definitions and aspects of information reveal the problem. The definition is almost everything and anything. Information appears to be an unknown similar to the "ether" of the middle ages. Of the 54 definitions and descriptions mentioned so far, the last definition in Table 3 has a managerial aspect: use. "Information is data processed for some use" (Nekmann, 1994). This definition is short enough to be remembered.

Table 1. Data Emphasis in Definition of Information

EMPHASIS	INFORMATION DEFINITIONS (quotes):	REFERENCE:
Data	Processed data - . . . organized, interpreted, and possibly formatted, filtered, analyzed, and summarized.	(Gordon & Gordon, 1999)
Data	Collections of facts [data] organized [to] have additional value beyond the value of the facts themselves.	(Stari & Reynolds, 1999)
Data	Data whose form and content are appropriate for a particular use.	(Alter, 1999)
Data	Data in the environment available for interaction with human information processing capabilities -- objects, artifacts, sounds, smells, visual and tactile phenomena, activities, events, or phenomena of nature.	(McCreadie & Rice, 1999)
Data	. . . processed data, or meaningful data.	(McLeod, 1998)
Data	The information system refines data into information. [with], Data is [sic] raw facts that have no meaning on their own.	(Morneau, 2000)
Data	Information is a sequence of data that is meaningful in a process . . . Noise . . . is a random sequence , , , neither . . . predictable.	(Kurzweil, 1999)
Data	. . . numbers, graphics, or words -that has been organized, systematized, and represented so that the underlying patterns become clear.	(Pfaffenberper, 2000)
Data	Data that have been converted into a meaningful and useful context for specific end users.	(O'Brien, 1998)
Data	What constitutes information to one person may be data to another. If it doesn't make sense to you, it doesn't qualify.	(Wurman, 2001)
Data	. . . comes from the form data takes as we arrange and present it in different ways.	(Shedroff, 2001)
Not Data	Information . . . does not just mean data. Qualitative judgments, affiliations, and emotion are all part . . . Denotation and connotation are fundamentally inseparable.	(Evans & Wurster, 2000)

Table 2. Mental and Cognitive Definitions of Information

EMPHASIS:	INFORMATION DEFINITIONS (quotes):	REFERENCE:
Meaning	. . . meaning that human beings assign to or extract from data . . .	(Davis, 1995)
Meaning	Data that have been organized so they have meaning and value to the recipient	(Turban, McLean, & Weatherbe, 1999)
Meaning	Information is the meaning of the representation of a fact (or of a message) for the receiver.	(Heylighen, 1999)
Meaningful	Data that have been shaped into a form that is meaningful and useful to human beings. [With data being defined as . . . streams of raw facts representing events occurring in organizations or the physical environment before they have been organized and arranged into a form that people can understand and use.	Loudon & Loudon, 2002)
Meaningful	Data that have been converted into a meaningful and useful context for specific end users.	(O'Brien, 1998)
Meaningful	Information = Data + Meaning	(Devlin, 1999)
Cognitive	. . . the knowledge increment brought about by a receiving action in a message transfer	(Falkenberg & others, 1998)
Cognitive	Requires unit of analysis, need consensus on meaning, human mediation necessary	(Davenport, 1997)
Abstraction	. . . an abstraction from any meaning a message might have and from any particular form a message might take.	(Raskin, 1999)
Understanding	. . . is that which leads to understanding.	(Wurman, 2001)
Communication	. . . relates not so much to what you *do* say, as to what you *could* say. . . . is a measure of one's freedom of choice when one selects a message . . . - Σ pi log pi, [p being the probabilities of choice	(Shannon & Weaver, 1949)
Communication	Part of the process of communication.	(McCredie & Rice, 1999)
Context	. . . data that have meaning within a context	(Oz, 2000)
Context	Information is defined only when we know the context	(Norretranders, 1991, p. 61)
Context	. . . transmission of thoughtful messages that reveal the relationships and patterns (the context) among the data presented . . . organizing them into a meaningful form, presenting them in appropriate ways, and communicating the context around them.	(Shedroff, 2000)
Context	Without context, information cannot exist . . . also from the context and intent of the person interpreting it.	(Shedroff, 2001)
Context-specific & relational	. . . provides a new point of view for interpreting events or objects, which makes visible previously invisible meanings or sheds light on unexpected connections. [Contrasted with] knowledge [which] is about beliefs and commitment . . . action	(Nonaka & Takeuchi, 1995)
Knowledge Representation	Documents, books, periodicals, some visual and auditory representations, abstractions, and citations	(McCreadie & Rice, 1999)

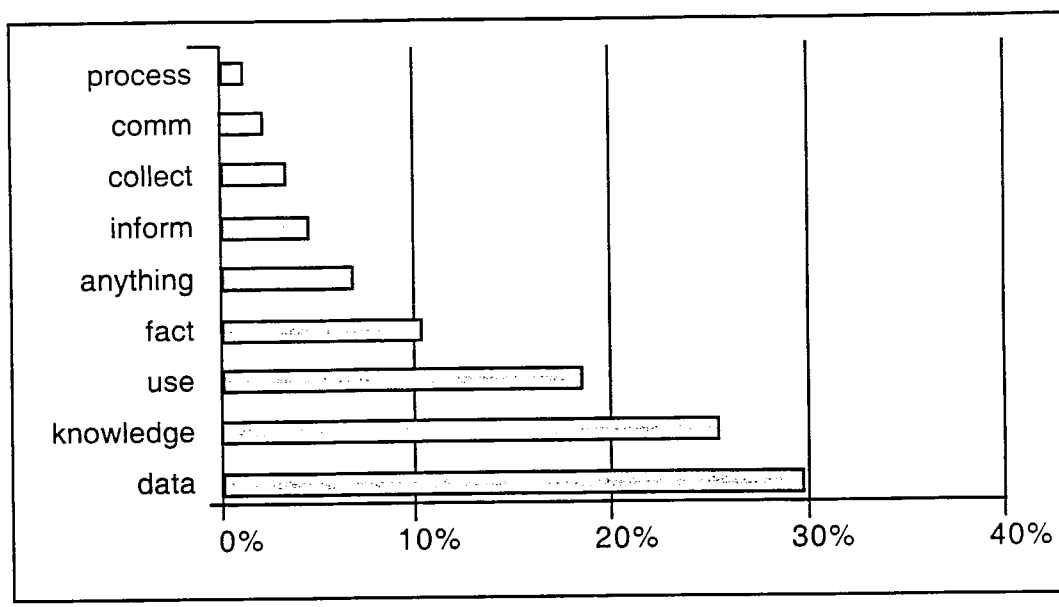
Table 3. Other Definitions of Information

EMPHASIS:	INFORMATION DEFINITIONS (quotes):	REFERENCE:
Based	. . .based on the characteristics of the particular knowledge discipline and targeted users.	(Rosenberg, 2001)
Change	. . . a change registered in an otherwise steady state	(Brown & Dugird, 2000)
Commodity	. . . can be produced, purchased, replicated, distributed, manipulated, passed along, controlled, traded, and sold	(McCreadie & Rice, 1999)
Competitive intelligence (CI)	. . . information about competitors' activities from public and private sources, and its scope is the present and future behavior of competitors, suppliers, customers, technologies, acquisitions, markets, products and services, and the general business environment	(Vender, 1999)
Constraint	Information = Representation + Constraint [regularities & conventions]	(Devlin, 1999)
Difference Equation	Any difference that makes a difference	(Bateson, 1979, 1991)
Influence	. . . ability of the different cells to influence each other and how well this is passed on or correlated.	(Ward, 2001)
Information Equation	Information = Representation + Procedure for encoding/decoding	(Devlin, 1999)
Learner	. . . that [which] comes out of the computer has to be "processed" by the learner.	(Hyerle, 2000)
Organization	. . . focused a specific organization of content.	(Rosenberg, 2001)
Presentation	. . . primarily centered on effective presentation.	(Rosenberg, 2001)
Processing model	. . . a flow of information between various information stores and transformational processes . . . assume a linear progression of processing in stages . . . [Includes sensory memory, perception, working memory, long term memory, and attention resources.]	(Wickens et al., 1998)
Purpose	. . . purpose defined primarily by users.	(Rosenberg, 2001)
Quality Attributes	That which is Timely [Opportune], [Current], [Frequent], [Traceable over time periods], Accurate [Precise], Relevant, Complete, Flexible, Reliable, Simple, Verifiable, Accessible, Secure [Scoped or Focused], [Clear], [Detailed], [Ordered], Economical, [Consistent], and shows [Performance] in a [Presentation on Media]. Note: those in brackets were added	(Stair & Reynolds, 1999)
Reach	. . . measure of the degree to which information can be shared.	(DoD, 2001)
Resource	. . . equivalent of yesterday's factories . . . considerably more vulnerable	(Schwartau & Winn, 1997)
Richness	. . . a measure of the quality of information [content, accuracy, timeliness, relevance]	(DoD, 2001)
Sequence	. . . sequenced for optimum reference.	(Rosenberg, 2001)
Stimuli	. . . stimuli that has meaning in some context for its receiver.	(SearchDatabase, 2001)
Symbols	. . . carried by symbols that are manipulated according to prescribed rules . . . given by stimuli from the environment . . . encoded in trains of action potentials as bits that represent qualities, aspects or features of the stimuli.	(Freeman, 1999)
Use	. . . data processed for some use	(Nekumann, 1994)

SURVEYS FOR A DEFINITION

What are nonprofessionals' definitions of information? On the first day of class during Spring Semester 2000 in a junior-level Management Information System course, we asked 245 worker-students for their definition of information. One hundred and forty nine claimed they worked in various occupations, e.g., 9 percent as servers/waitress/valets, 5 percent as manager/supervisors, 4 percent as secretaries/receptionists, 4 percent in information technology, 3 percent as bank tellers, and 3 percent as accountants. Of the 210 that give a definition, 30 percent included the word data, 25 percent included know or knowledge, and 19 percent included use or useful. Figure 1 below shows the frequency of words found in their definitions.

Figure 1. Word Frequency in Information Definition (Undergraduates)

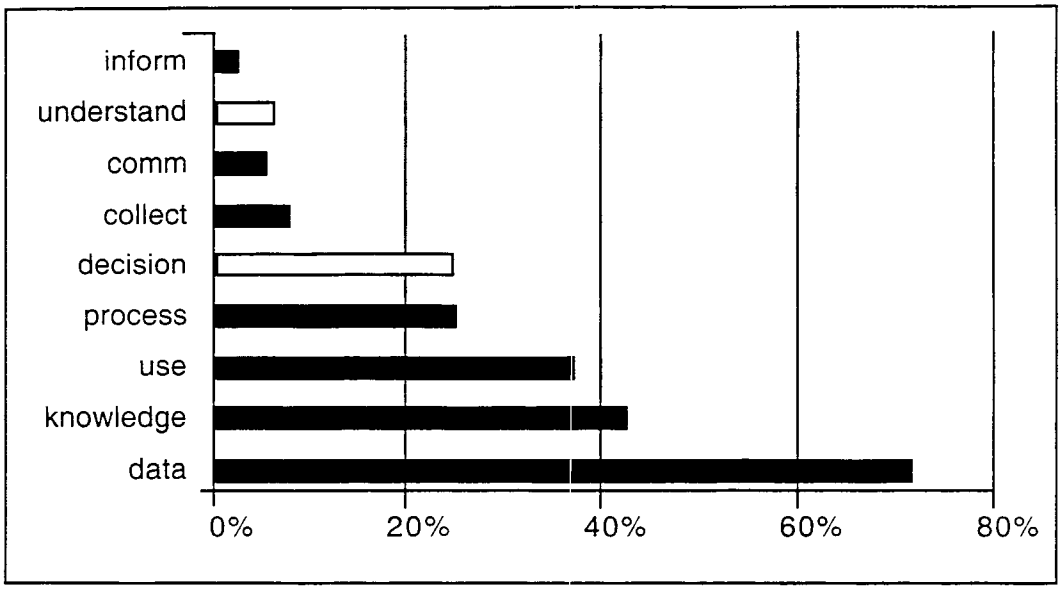


Four percent listed knowledge and information as synonyms and two percent listed data and information as synonyms, as some authors do. Disregarding the synonyms, four pairs of definitions were same number: (1) useful data; (2) organized data; (3) knowledge gained; (4) ideas, concepts, and thoughts. Only 27 (11 percent) of the 245 had words that agreed with another one.

Separately, forty-three graduate students, middle-grade managers working in government, majoring in Information Systems had more words to define information as can be seen in differently-scaled Figure 2. Other than the terms, understanding and decision, the quantity of words appears to be the basic difference between undergraduate and graduate students. Nevertheless,

similar to scholars and laymen-students, graduate students apparently do not have a common definition of information either. Few agree on a definition for information. The surveys did not lift the definitional haze.

Figure 2. Word Frequency in Information Definition (Graduates)

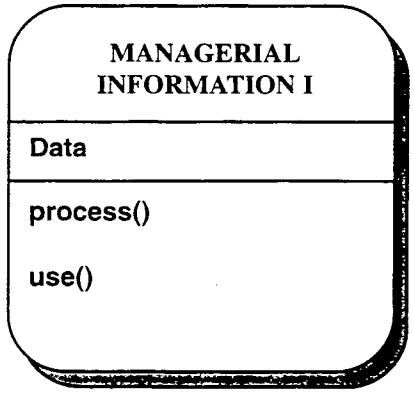


CONSIDERATIONS

Obviously, the term information is without a common, agreed to definition. Information is no longer a viable concept; it is mystical, perplexing. **Managerial information,** alternatively, could be aligned with an accepted concept - a class. Imaginably, the definition of managerial information is a concept that may be thought of as a class (Martin & Odell, 1998). Built with this framework and its familiar visual symbol, such as a "Class-&-Object" symbol shown in Figure 3, MANAGERIAL INFORMATION I (Coad, 1990; Norman, 1996). Data is an attribute or element of information. Both process() and use() are methods, actions, or operations to be taken on the data. Incidentally, market information and financial information have been defined (Accountants' Liability, 2001; Dhaliwal, 2001).

In its simplest form, Figure 3 shows the familiar structure of a class and the essential components of managerial information: data, use, and process. Using Nekmann's short definition, "information is data processed for some use" (Nekmann, 1994), three inferences can be proposed.

Figure 3. Managerial Information I



In its simplest form, Figure 3 shows the familiar structure of a class and the essential components of managerial information: data, use, and process. Using Nekmann's short definition, "information is data processed for some use (Nekmann, 1994)," three inferences can be proposed.

One, Nekman's definition clearly separates information and data as two distinctly different elements, with data being operated on, processed for some use before becoming information. With this definition, data and information obviously are not synonyms, as many laymen and authors seem to believe. Additionally, many authorities agree that information is composed of data. It is elementary to its composition and is always more than one datum, implicit or explicit. This implies that information requires the processing of two or more datum. One datum is not an object of the class: MANAGERIAL INFORMATION I. It takes at least two datum, so "42" does not qualify.

Two, without a use(), information may be considered as educational, entertainment, news, incidental, or perhaps transcendental. Given the practicality and prudence of management, use or useful seems to fit the modifier managerial.

Three, data need to undergo a process() to become information. Data may be created or assigned in only five ways: by location, alphabets, time (point or duration), category, and hierarchy or magnitude (Wurman, 2001). Three of these creative processes -- alphabets, time, and category -- are contrived. Processing by location requires agreements on relationships and directions, such as what is connected to what and what is up, down, close, and far. Hierarchy or magnitudes require agreements on both relationships and measurements, what is higher or lower and by how much. Measurements are nothing more or less than an alignment to an agreed standard. All of these assignments can be further processed as ratios, such as location/time and

category/location. How data are organized and sequenced is another process. All the processes require human intervention; neither data nor information appears naturally. Information is a human artifact.

Going back to the idea that information requires the processing of two or more datum, only one datum may be all that needs to be sensed, however. The other datum may be remembered. Therefore, Figure 3, which is just a beginning, does not include two other fundamental processes—data needs to be sensed and remembered or stored. To sense() is a function that means there is a notice of a difference in the data. This difference can be sensed from a comparison of an external datum and an internal datum, and this latter requires storage. To be able to store means that the difference in data has to be retained for long enough to be perceived, perhaps even to be remembered (Wickens, 1998). Thus, if a previous datum is remembered or acknowledged, one datum may be enough to be sensed.

Sensing implies simplex signaling, usually without feedback and producing this notice for humans often requires an art form. Content, contrast, edges, color, and context billboard data stimulate our notice or attention. If the storage lasts longer than a day, this remembrance may be termed knowledge. Incidentally, humans, other life forms, and machines have the ability to sense and store data, shown in Figure 4.

Figure 3. Managerial Information I

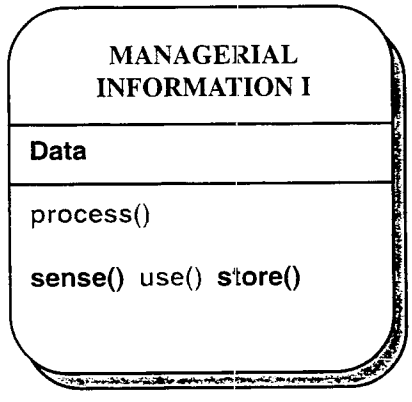
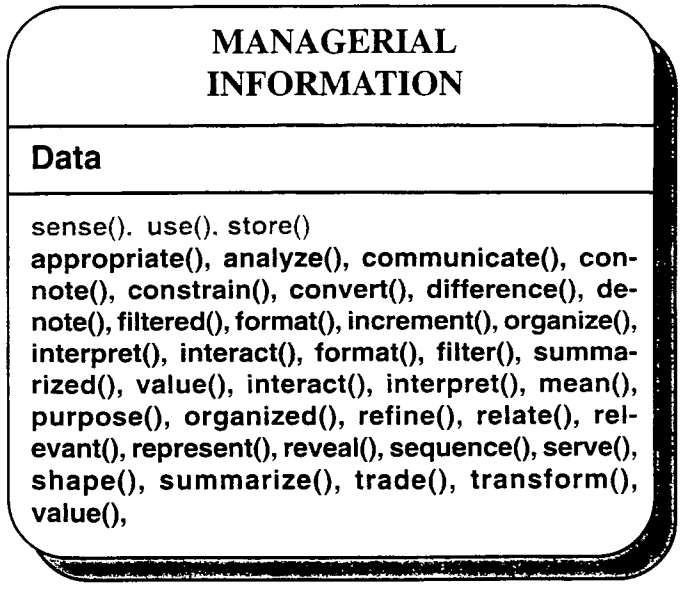


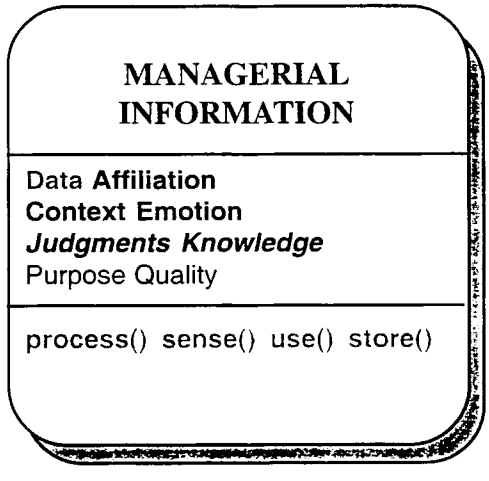
Figure 4 may be expanded to include many aspects of process() as can be seen in Figure 5. Data may be treated in many and varied methods.

Figure 5. Many Different Processes



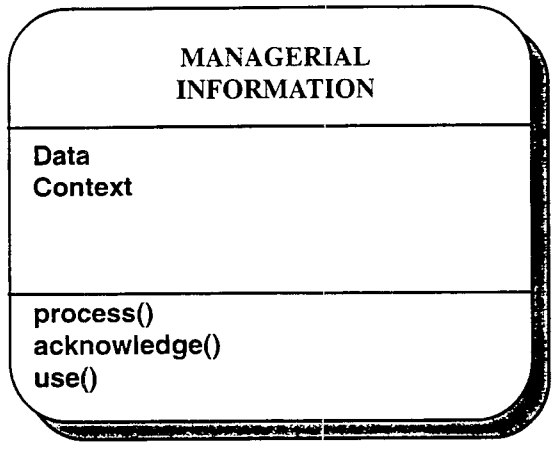
Managerial information takes place in someone's head and in a certain situation, a context. The latter can sometimes be identified or inferred from a label being attached to the date. These aspects may be seen in Figure 6.

Figure 6. Contextual Aspects



Context, to be of any consequence, needs to be acknowledged in one's head. Likewise, affiliation, emotion, judgments, knowledge, purpose, and a sense of quality are played out in one's head. All of these attributes are outside the data, but each affects the interpretation of the data. All are context. In simplifying, the process of notice() and the retained information, knowledge, may be combined into a process called acknowledge().

Figure 7. Managerial Information in Summary



PROPOSED DEFINITION OF MANAGERIAL INFORMATION

In establishing a working definition of information, four issues emerge. One, information is a processed form of data. Two, someone needs to acknowledge that information exists. Three, one needs to be able to use it. Four, relevance of information is context specific. Synthesizing the four elements, **Managerial Information** may be defined simply as ***processed data that managers acknowledge and use in various contexts.***

Dissecting managerial information into the five elements of data, process, acknowledgment, context, and use renders a simple framework. It allows us to consider the many processes involved in converting data into information, and that the latter is dependent on managers' heads: what is already in them, what is arriving, and where their heads are. Additionally, putting information or other resources to use remains the essential reason for managers. With the last three of the elements of information (acknowledgment, context, and use) dependent on the managers, perhaps our analyses of information should start with the managers - not the data and processes. For the basics, managers remain the initial source.

REFERENCES

Accountants' Liability (2001). Chapter 5. Fraud. § 5:2 Elements § 5.2.2[C]. Practising Law Institute of LEXIS-NEXIS® Academic Universe - Document.

Adams, D. (1989) (originally, 1979). *The hitchhiker's guide to the galaxy.* New York: Douglas Adams Visual Publications.

Alter, S. (1999). *Information systems: A management perspective* (pp. 48-49). New York: Addison-Wesley Educational Publishers.

Bateson, G. (1979). *Mind and nature: A necessary unity* (p. 228). New York: E. P. Datton.

Bateson, G. (1991). *A sacred unity, further steps to economy of mind* (p. 309). New York: Cornelia and Michael Bessie.

Brown, J. N., & Duguid. (2000). *The social life of information* (p. 138). Boston, MA: Harvard Business Press.

Burke, J. (1996). *The pinball effect: How Renaissance water gardens made the carburetor possible - and other journeys through knowledge* (p. 5). Boston: Little, Brown and Company.

Coad, P., & Yourdon, E. (1990). *Object-oriented analysis* (2nd ed.) (p. 56). Englewood Cliffs, NJ: Prentice-Hall.

Dhaliwal, H. (2001). *Business wire* of LEXIS-NEXIS® Academic Universe - Document.

Davenport, T. H. (1997). *Information ecology: Mastering the information and knowledge environment* (p. 9). New York: Oxford University Press.

Davis, W. S. (1995). *Management, information, and systems: An introduction to business information systems* (p. 8). St. Paul, MN: West Publishing.

Department of Defense. (2001). *Information superiority: Making the joint vision happen.* Washington, DC: US Government.

Devin, K. (1999). *InfoSense: Turning information in knowledge* (pp. 33 & 34). New York: W. H. Freeman.

Drucker, P. F. (1999). *Management challenges for the 21st century* (pp. 97-111). New York: Harper Business and Harper Collins.

Drucker, P. F. (1988, January-February). The coming of the new organization. *Harvard Business Review, 66,* 45-53.

Evans, P., & Wurster, T. S. (2000). *Blown to bits: How the new economics of information transforms strategy* (p. 11). Boston, MA: Harvard Business School Press.

Evans, P., & Wurster, T. S. (1997, September-October). Strategy and the new economics of information. *Harvard Business Review*, 74.

Falkenberg, E. D. (1998). In Hesse, W., Lindgreen, P., Nelsson, B. E., Oei, J. L. H., Rolland, C., Stamper, R. K., Van Assche, F. J. M., Verrign-Stuart, A. A., and Voss, K. (Eds.). *A framework of information systems concepts* (p. 68). University of Leiden, Netherlands (FRISCO).

Freeman, W. (1999). *How brains make up their minds.* London: Phoenix.

Gordon, J. R., & Gordon, S. R. (1999). *Information systems: A management approach* (2nd ed.) (pp. 6 & 7). Orlando, FL: Harcourt Brace & Co.

Jensen, R. (1999). *The dream society: How the coming shift from information to imagination will transform your business.* New York: McGraw-Hill.

Hyerle, D. (2000). *A field guide to using visual tools.* Alexandria, VA: ASCD.

Heylighen, F. (1999). *Web dictionary of cybernetics and systems.* Website: http://pespmc1.vub.ac.be/ASC/INFORMATION.html

Kurzweil, R. (1999). *The age of spiritual machines* (p. 30). New York: Penguin Putnam.

Laudon, K., & Laudon, J. (2002). *Management information systems: Managing the digital form* (p. 6). Upper Saddle River, NJ: Prentice Hall.

Martin, J., & Odell, J. (1998). *Object-oriented methods: A foundation* (UML ed., 2nd ed.) (p. 35). Upper Saddle River, NJ: Prentice Hall.

McCredie, M., & Rice, R. (1999). Trends in analyzing access to information. Part I: Cross-disciplinary conceptualizations of access. *Information Processing and Management, 35,* 45-76.

McLeod, R. (1998). *Management information systems* (7th ed.) (p. 16). Upper Saddle River, NJ: Prentice Hall.

Morneau, K. (2000). *MSCD guide to Microsoft solution architectures* (p. 2). Cambridge, MA: Course Technology.

Nekmann, S. (1994). *Strategic information systems: Competition through information technologies* (p. 185). New York: Macmillan College Publishing.

Nonaka, I., & Hirotaka, T. (1995). *The knowledge-creating company* (p. 58). Oxford: Oxford University Press.

Norman, R. J. (1996). *Object-oriented systems analysis and design* (p. 103). Upper Saddle River, NJ: Prentice Hall.

Norretranders, T. (1998). *The users illusion: Cutting consciousness down to size* (p. 40). New York: Viking Penguin.

O'Brien, J. A. (1998). *Introduction to information systems: An internet worked enterprise perspective* (2nd Alternative Edition). Boston, MA: Irwin/McGraw-Hill.

Oz, E. (2000). *Management information systems* (2nd ed.). Cambridge, MA: Course Technology.

Pfaffenberger, B. (2000). *Webster's new world dictionary of computer terms* (8th ed.) (p. 275). Foster City, CA: IDG Books Worldwide, Inc.

Raskin, J. (1999). Presenting information. In R. Jacobson (Ed.) *Information Design* (p. 342). Cambridge, MA: MIT Press.

Rosenberg, M. J. (2001). *E-learning: Strategies for delivering knowledge in digital age*. New York: McGraw-Hill.

Rodgers, R. D. (1988). Education: Education & participants. *NY Times (25 Feb 85) in Simpson's Contemporary Quotations* of LEXIS-NEXIS® Academic Universe - Document.

Schwartau, W. (1997). An introduction to information warfare. In R. L. Pfaltzgraff & R. H. Shultz Jr. (Eds.) *War in the Information Age* (p. 48). Dulles, Virginia: Brazzey's.

Shannon, C. E. & Weaver, W. (1949). *The mathematical theory of communication.* Urbana, IL: University of Illinois Press.

SearchDatabase (2001). Website: http://searchdatabase.techtarget.com/sDefinition/o,,sid13_gci212343,00.html

Shapiro, C. & Varian, H. R. (1999). *Information rules: A strategic guide to the network economy* (p. 3). Boston, MA: Harvard Business School Press.

Shedroff, N. (1999). Information interaction design: A unified field theory of designs. In R. Jacobson (Ed.), *Information Design* (p. 270). Cambridge, MA: MIT Press.

Stair, R. M., & Reynolds, G. W. (1999). Principles *of information systems: A managerial approach* (p. 7). Cambridge, MA: Course Technology-ITP.

Turban, E. et al. (1999). *Information technology for management: Making connections for strategic advantage.* New York: John Wiley & Sons.

Vender, R. G., Vaneck, M. T., Guynes, C. S. & Cappel, J. J. (1999, August). CEO and CIP perspectives on competitive intelligence. *Communications of the ACM, 42*(8), 109.

Ward, M. (2001). *Universality*. London: Macmillan.

Wickens, C. D., Gordon, S. E., & Liu, Y. (1998). *An introduction to human factors engineering*. New York: Longman.

Wurman, R. S. (2001). *Information anxiety2*. Indianapolis, IN: QUE.