CHAPTER 2

2. THE NATURE OF INFORMATION

2.1 Introduction

The term "information" is commonly used in everyday language and everyone seemingly know and understand exactly what is meant by it. It is a word that any child gets to know at a very early age and most people go through their entire life without ever seriously considering the meaning of the word. There is also nothing wrong with it: We all understand what is meant when we encounter the word, whether in writing or in verbal communication.

It is only when one tries to define the term when unforeseen problems arise. All of a sudden the obvious becomes the far-from-obvious. Especially when the "experts" are consulted, things really get complicated: The librarians have their opinion, the computer gurus, the psychologists, educationalists and philosophers all have their own interpretations. Buckland (1991: 3) writes: "An exploration of *information* runs into immediate difficulties. ...The definitions may not be fully satisfactory, the boundaries between these uses may be indistinct, and such an approach could not satisfy anyone determined to establish the one correct meaning of *information*".

It is impossible to determine without qualification who is right and who is wrong, as it depends entirely on the context in which the term is used, as we will see later on. Yet, for the purposes of this study, we need to define it. Furthermore, not only do we need to define "information", we need to define its family of related terms: Data, knowledge and wisdom.

2.2 Data, information, knowledge and wisdom

2.2.1 Data

Blumenthal (in Duffy and Assad, 1980: 13) defines data as follows: "A datum is an interpreted raw statement of fact". Davis and Rush (in Broadbent, 1984: 211 - 212) write that data are "the result of measurement or observation."

Diener (in Horton, 1979: 59) defines data as "sensory and perceptual phenomena" and information and knowledge as "conceptual phenomena" which is therefore aimed "at the cognitive level of perception". McInerney (1992: 172) describes data as "What is given. What is perceived with the senses and the results of experiments...".

Sippl and Sippl (1981: 126) describe data in their "Computer Dictionary" as "A general term used to denote any or all facts, numbers, letters and symbols that refer to or describe an object, idea, condition, situation, or other factors. It connotes basic elements of information which can be processed or produced by a computer". In "Webster's New world Dictionary" (Guralnik, 1984: 360), the term "datum" is described as "...something known or assumed; fact from which conclusions can be inferred".

Scharf (1984: 40) views information along a continuum where data are the lowest (and least expensive) and knowledge is the highest (and most expensive).

Taggart and Silbey (Rabin and Jackowski, 1988: 178), defining data as "...raw facts or impressions", offer an example of data. The sentence "It is raining" is understandable to anyone, but it does not have an obvious meaning. Likewise the characters "$*6" appears to be a random group of characters.

Introna (1992: 2.37) describes data as "basic facts, facts that can be shown to be true if they correspond to reality". He bases this viewpoint on the correspondence theory of truth which claims that truth is a correspondence between what is believed and an independent reality (McInerney, 1992: 172).

Introna's definition and also those defining data in terms of "facts", have a subtle but important implication. Facts, by definition, must be real and true; if not true, they cannot be facts. This "truth" factor severely limits the scope of data as it excludes all non-facts, theories and hypotheses. Data must be broader in scope than only truths. For example, writings on the supernatural

or quarks, although neither real nor factual, must also qualify as data.

To overcome the limitation of a definition in terms of "facts", it is suggested that a definition in terms of "attributes" be considered. An attribute is a quality or characteristic of someone or something and does not necessarily have to be true.

Data are therefore defined as attributes with no apparent meaning. However, importantly, data have *potential* for meaning, analogous to a rock on top of a mountain having *potential* energy.

2.2.2 Information

We refer to information on a daily basis and in so doing we believe we know what we mean by it. It is only when we try to accurately define the term when we find that there are various fitting statements; all equally valid, but each one also not universally valid (Otten in Debons, 1974: 93). Broadbent writes: "Most efforts [of defining information] would appear to be contextual in nature" (1984: 211).

2.2.2.1 Current definitions

Put very simply, information is processed data which has meaning for the user (Ahituv and Neumann, 1982: 5). In this context "data" points to unprocessed and unevaluated attributes which do not have any meaning on their own. The attributes must first be put into context before it will have meaning or value and therefore become "information". Boland (1987: 371) calls the notion that information is structured data, a "fantasy". He rightly points out that "meaning" is something entirely different from "structured data" - by equating them, the importance of dialogue for all human understanding is denied.

Blumenthal (in Duffy and Assad, 1980: 13) defines information as "data recorded, classified, organized, related or interpreted within context to convey

meaning". In a circular (number A-130) to the Heads of Executive Departments by the *Director of the Office of Management and Budget* of the United States, the term information is described as "...any communication or reception of knowledge such as facts, data, or opinions, including numerical, graphic, or narrative forms, whether oral or maintained in any medium, including computerized data bases, paper, microfilm, or magnetic tape" (Miller, 1985: 52741).

Porat, who undertook the study on the information economy, proposes the following definition of information: "Information is data that have been organised and communicated" (Broadbent, 1984: 209). Taggart and Silbey (1988: 178) describe information as offering "more meaning" than pure data and "...data that has usefulness (value) to a decision maker in a current situation". They take the example "It is raining" (an example of data) a step further: "It is raining and my car windows are open". This sentence forces the person into a decision making situation, namely whether or not to go out and close the windows to prevent damage to the seats. The fact that it has meaning and can be useful, transforms data into information.

Farradane (1979: 13) defines information as "any physical form of representation, or surrogate, of knowledge, or of a particular thought, used for communication". He points out that "only the ultimate effects of communication, the actions of the recipients, will be identifiable as directly observable processes". He criticises definitions using phrases such as "usefulness", "an increment in knowledge", resolving uncertainty", "value in decision making", and others, as "to be only expressions of ignorance of the nature of thought" (Farradane, 1979: 13). Hoffmann (1980: 292) agrees with this view and points out that the "value in decision making" definition is situation-dependent. A definition of information, according to Hoffmann, cannot be conditional upon human reaction.

Economists have been studying information because of "the role that information plays in the functioning of competitive markets, the understanding

of the increasing amount of resources devoted to the production and distribution of information, and the analysis of how more or better information may improve the market position of one or a group of economic 'players'" (Braunstein, 1981: 9). The identification of an information sector in the economy was done by Machlup and followed by Porat (in Braunstein, 1981: 10). According to Braunstein (1981: 10) economists view information as a commodity; either a good or a service.

Naisbitt (1984: 36) pragmatically states: "Information is an economic entity because it costs something to produce and because people are willing to pay for it".

Defining information in an economic sense as a commodity, is, according to Horton (1979: 58), an abstraction of the concept of information. The commodity view is adequate when information is viewed as "something", but is completely inadequate to describe the value that is derived from that information. In order to use this definition (as commodity) to convey meaning, a further level of abstraction must be piled onto an abstraction. This leads to confusion "which totally obscures the original problem" (Horton, 1979: 58).

Cronin (1985b: 129) makes the following interesting comment on information: "Information can be described as a commodity or good, but it may be more instructive to think of information as a social and economic lubricant. Information is a resource which conserves other resources: one which facilitates, integrates and enables".

Tricker (1982: 29) proposes that information can be considered at four levels, namely:

- Level one: Basic data. Tricker regards data on this level to be facts such as the height, weight and age of a person, the date or the amount and payee on a cheque. He further regards data on this level as raw data "which contains the potential information, but only after processing".

- Level two: Information as a message. If the level one data are aggregated or analyzed so that, for example, the personal characteristics become details of a class or the cheques drawn are totalled to show the effect on cash flow, then the level one data become level two information.

  This information can be made available in a report, a book, picture on a screen or as an announcement over a loudspeaker. It therefore can be looked at as a message. However, no concern is given to the needs of the recipient of the message, nor to any meaning he derives from it. Information, at this level, is a function of the message alone, or

  $I = f(d)$,
  where
  I = Information and d = data, or message.

  Tricker chooses to consider the level one and level two information as being data and not yet as information. The term information is reserved for the next level.

  In considering data at this level, it is clear to see why more data do not lead to better informed executives. "Many so-called information systems in the past concentrated on the handling of data - ignoring the information needs of the potential user" (Tricker, 1982: 31). Although Tricker sees this as "in the past" there is too much evidence that this is still happening today.

- Level three: Information in use. To become information, according to Tricker, the data received must be interpreted. The user is therefore essential for the information to acquire a value; before that, it is data. It is here where information acquires another dimension, namely information as a process: A human thought process. Boettinger (in Tricker, 1982: 32) puts it as follows: "..information has no meaning unless its final destination is in the cerebral cortex".

Information (I) on this level therefore becomes a function of the data (d) and the user (u), or

$$I = f(d,u).$$

The sender of the information must be aware of the needs of the user, such as language, semantics and symbols that are relevant to the user.

Tricker (1982: 32) points out that an identical message can have different meanings to different people. "Intelligence, education, training in the language or notation used in the data, previous relevant experience and perceptual abilities can all affect the meaning derived from the data". He quotes the example of the message that the patient's temperature is 104 degrees is likely to have a different meaning to the patient, his doctor and his accountant.

- Level four: Valuable information. To appreciate information in its totality, the meaning derived from the data by the user must also be taken in consideration. It is therefore important to determine to what extent the uncertainty of the recipient is reduced and/or his knowledge is increased.

  It is thus necessary to take the organisational role of the user into consideration. Information (I) on this level, therefore becomes a function of the data (d), the user (u) and the organisational situation(s) of the user, or

  $$I = f(d,u,s).$$

  The same message can have different effects on the same user if the organisational situation of the user is taken into consideration. Tricker gives the following example: The message that taxes are to be raised in order to give teachers an increase in salary, will have different information content for the same person when he thinks of himself as a teacher,

> a tax payer or a potential candidate for a political office.
>
> By taking the organisational situation into consideration in the model of information, it is clear to see that organisational structure, management development and organisational development are closely related to the structure of management information systems (Tricker, 1982: 34).

Tricker makes an important point, namely, that information relies heavily on and is entirely dependent upon the user and his situation. Different users, all having different backgrounds and situations, may attach different meaning to the very same data. It can therefore be concluded that information is highly contextual and dependent on perspectives.

Langefors (1993: 150), like Tricker, also defines information in by using an equation. This equation became known as the "Infological Equation" and is as follows:

$I = i(D, S, t)$

where

I = Information (or knowledge) produced from the data, D and the pre-knowledge, S, by the interpretation process, i, during the time, t. This equation highlights two important elements. Firstly, there is the concept of an interpretation process and, secondly, by implication, that information can only be achieved by involving a human being.

Debons and others (in Broadbent, 1984: 213) suggest two definitions for information:

- Source-based definition: Information is a symbol or a string of symbols which have potential for meaning (the commodity of information). (This definition relates strongly to the definition of data in the previous section.)
- Receiver-based definition: Information is that which adds to or changes (my) picture of the universe (the process of informing).

Hoffmann (1980: 293) worked on qualitatively determining the information content of documents. He defines information as "an aggregate (collection or accumulation) of statements, of facts and/or figures which are conceptually (by way of reasoning, logic, ideas, or any other mental 'mode of operation') inter-related (connected)", or

$$I = f(n,e),$$

where I = Information, n = nodes for facts or figures (ie. data) and e = edges for meaningful connections between the facts/figures (Hoffmann, 1980: 293, 1981: 133). Another way of expressing the definition is: "Information is a function of facts/figures and of their meaningful connections" (Hoffmann, 1981: 133). It would appear that in Hoffmann's opinion, meaning is measured by the logic in which the facts and figures are connected. "Meaning", therefore, has a completely different meaning to "meaning" as attributed by a person to a message which he receives.

Hoffmann's definition does not contribute to the quest of what the difference between data and information is. A number of data elements (facts or figures in Hoffmann's terminology) can be logically connected, yet it may be entirely meaningless to a recipient for a variety of reasons. Hoffmann would classify this as information whereas our earlier definition would classify it as data ("attributes with no apparent meaning"). Hoffmann's view certainly helps to give one an idea of the informational content of a document - the higher the number of facts/figures and their logical connections in relation to the total number of words, the higher the informational content - but it still does not say

anything about the meaning to the recipient.

Introna (1992: 2.46) argues that information is "understanding based on experience (*Erlebnis*)." Information, in his view, can only exist in the mind and nowhere else. The moment that data are *appropriated* by a (receiving) person, it becomes information: "There is a point where appropriation is complete and one can say 'now I understand'. Data have now been transformed into information" (Introna, 1992: 2.48). Expanding this argument, the moment when such a person puts his thoughts (and thus his understanding) down on paper, it reverts back to data (until appropriated by someone when it may become information). Introna's view, therefore, is that only data can be a commodity, but information not. Even if a person should be able to sell the information he has accumulated in his mind, the person buying it, is buying data unless he then appropriates it himself when it becomes information.

Although Introna's definition cannot be argued against, it does place a restriction on the scope of information. Hoffmann (1980: 292) identifies information to appear in three "phases", namely, (i) the assimilated phase (in the human mind), (ii) the documented or recorded phase and (iii) the transmitted phase (communication). Introna's definition acknowledges only the first phase.

Buckland (1991: 3) identifies three uses of the term "information":

- Information-as-process. This refers to the process of being informed; when one's knowledge is expanded.

- Information-as-knowledge. During the process of being informed, something is imparted in the process. This "something" is commonly called information. This is something intangible, personal, subjective and conceptual.

- Information-as-thing. The term is also used to describe objects such as

documents, books and data. When information-as-knowledge is expressed, communicated, described or represented in any way, such expression, description or representation would be classified as information-as-thing.

Buckland quotes many writers who have disagreed over many years with the notion that information can be some-"thing". He then concludes: "But language is as it is used, and we can hardly dismiss information-as-thing so long as it is a commonly used meaning of the term *information*" (Buckland, 1991: 4). He furthermore points out that the studying of information systems and information retrieval systems must be based upon the view of information-as-thing only. He writes: "The development of rules for drawing inferences from stored information is an area of theoretical and practical interest. But these rules operate upon and only upon information-as-thing" (Buckland, 1991: 4).

Buckland views information-as-thing and data (in the information systems sense) as synonymous.

From the above definitions, the following can be concluded:

- There is enough evidence that information can be viewed as a commodity or resource, implying that it is something tangible.

- Meaning is implicit in most, if not all, definitions. This leads to the implication that there must be an originator, a message (data) and a recipient.

2.2.2.2 Information and Meaning

The implicit "meaning" component in the definitions of information raises a new question: Where does one look for the meaning? Should two people, an originator and a recipient, have a verbal discussion, they can ensure that,

through verbal discussion, the meaning is the same for both. Should, however, the recipient be studying a product on his own (e.g. a book or a piece of art), the meaning which the recipient attaches may be very different to that of the originator.

Introna (1992) thus argues that (only) the recipient has the ability to transform data into information (hermeneutically via appropriation). When data have meaning to the recipient so that the appropriation takes place, it becomes information. However, Farradane (1986: 14) writes: "We cannot ...look for any meaning in the orbit of the recipient. The only valid meaning must be sought in the originator's thought" as the message (data) could be interpreted/appropriated differently, or not even at all, by different recipients, all perhaps different to the originator's thought.

The imperfections of language (and our limited ability to properly use it), cultural and other differences - in short: Different frames of references - all play important roles in the transmission of a message from an originator to a recipient. But even looking for true meaning on the originator's side, does not guarantee that it is absolute. "Investigation of the originator by asking questions which will elicit further versions of the [original] thought, or explanations, cannot be reliable even if confined to 'yes' or 'no' answers. The originator's knowledge structure will change in reaction to questioning" (Farradane, 1979: 14). Farradane argues that the recipient's interpretation of the meaning is probably still the most reliable (provided he aims for objectivity). He goes to lengths, however, to show the complexities in determining meaning at the recipient.

This leads to the conclusion that meaning exists at both the originator and the recipient(s). Meaning can never be absolute - even mathematical and scientific facts may have a certain meaning to a person, apart from the mathematical or scientific factual side. This is to be expected because context and perspective are human characteristics that cannot be separated from the human.

It needs to be pointed out that meaning does not have to involve an originator in the form of another person. Meaning can also originate from observation by any of the senses. A falling apple (data) is observed by Newton leading through logical reasoning, interpretation and comparing with existing knowledge to the theory of gravitation. Thus the observation of a falling apple gets new meaning.

Another important point is that meaning is never complete. Because it is related directly to context and perspective, it is always possible for someone else to put it in a different or wider context (Introna, 1992: 2.34).

2.2.2.3 Information defined

Farradane (1979: 13) questions the definitions treating information as "some holistic 'system' concept involving people, their attitudes and needs, and the effects of information transfer on decision making, social behavior, etc., ...". He finds them not to be workable definitions and claims that such definitions make it impossible to study any isolated part of the system, and "lead to philosophic speculations which provide no reliable explanations since there are many different points of view" (Farradane, 1979: 13). He feels that his definition ("[a] ...representation ...of knowledge") is more explicit than simply treating it as a concept.

Hoffmann (1980: 291) stresses the fact that whenever the term "information" is used, it is used with reference to the conditions and circumstances under which it is used. Any concepts, conclusions or explanations which may evolve would relate to the context in which the term is used.

Baratz (in Horton, 1979: 57) notes that a great deal of work on the definitions of information has been done in the Social Sciences, particularly psychology. These definitions are univocal in that information is context-specific. While psychologists agree in some regards, they differ in the way they conceptualize the problem but they recognize the limits of their conceptions.

Hollnagel (1980: 183), a psychologist, thinks that the problem facing information scientists in defining information is "far less serious than many seem to think". Because of the fact that Information Science is a behavioural science, it deals with phenomena which are directly observable. This means that everyone experiences it and can therefore express his or her own interpretation in natural language. This, according to Hollnagel, is quite different from the natural sciences which often deal with phenomena for which special terms in the natural language have to be created. In such an environment, it is essential that terms are precisely defined whereas, in the environment in which the behavioural sciences operate, the terms are mostly familiar and "hence, we know what we are talking about without having to define it rigorously first" (Hollnagel, 1980: 184). Hollnagel certainly has a point. It is because the term information is used so commonly that we all attach a certain meaning to it. Yet, in order to truly understand information, we need to define it; we cannot but rely on intuition.

Hoffmann (1980: 293) postulates that a definition must meet the following three conditions:

- The definition and the concept must be self-contained, that is, they must not be dependent on the circumstances or situation in which they are used. Thus, "the definition 'information is data of value to decision making' is situation dependent" and therefore invalid (Hoffmann, 1980: 292).

- The definition must be as precise as possible.

- The definition must be applicable to all subject areas in which the concept is used.

Farradane's (1980: 77 and 1979: 13) definition of information, namely a physical representation of knowledge used for communication, looks the most promising. Tested to the three criteria proposed by Hoffmann above, all three

are found to be satisfied. This definition agrees with many other definitions but not with the one proposed by Introna (1992: 2.43) ("Information is understanding"). Introna's definition implies that information can only exist in the mind and nowhere else. Information, according to Introna, can never be physically represented as is expressed in Farradane's definition.

The definition of Farradane also distinguishes between the terms information and data. Data, defined as meaningless attributes, can be viewed as a representation of knowledge, but meaningless facts do not qualify for the "...used for communication" component of the definition. Communication implies putting facts in context and providing perspective.

Farradane's definition expresses information in terms of an, as yet, undefined term, namely, knowledge. The definition should ideally express information in terms of its components rather than in terms of what it itself is a component of. This view will be revisited once knowledge is defined.

From the above it is clear that information depends on two aspects: Context and perspective. Through the sensory organs, a person is presented with data ("meaningless attributes"). Information is created if this data are transformed so that it becomes meaningful. Boland (1987: 363) describes information as "inward-forming" and writes: "[Information] is the change in a person from an encounter with data". This transformation can only be accomplished through the addition of context and perspective. In any communication, perspective is always present; not only does the parties consider their own point of view, but they also take into consideration the other party's point of view (Boland *et al.*, 1992: 2).

It is proposed that information is defined as **data put into context and in perspective**. The words "context" and "perspective" very elegantly describe what is meant: The latin *"contexere"* means *"to join together"*. Perspective means *"the relationship of aspects of a subject to each other and to a whole"*. Taken literally, the definition says that information is data joined together in

relationship to each other and to the whole.

This definition includes most of the current definitions: Context and perspective unequivocally imply meaning, but the definition is general enough to include meaning on the sides of both the originator and the recipient. It also implies some processing taking place with data, be it in the mind or somewhere else. It implies appropriation and interpretation of data. It includes all three "phases" of Hoffmann (1980: 292): Assimilated, documented and transmitted.

A last thought is whether information has to be true in order to be information. We already indicated that data are not necessarily only truths and if information is defined as data put into context and perspective, it follows that information does not have to be truths only.

2.2.3 Knowledge

Foskett (in Broadbent, 1984: 212) defines knowledge as "something in the mind" and views information as some form of "communicated knowledge". Gould (1986: 61) describes knowledge as "the result of a complex process in which ideas and information can be checked, tested, and challenged continuously and without restraint by all interested parties". Farradane (1980: 77) defines knowledge as "a memorable record of a process in the brain, something only available in the mind". Glaser, Abelson and Garrison (1983: 2) define knowledge to include: "...(1) facts, truths, or principles, often associated with (but not limited to) an applied subject or branch of learning or professional practice, (2) information or understanding based on validated, broadly convergent experience, (3) reliable identified exemplary practice, including unusual know-how; (4) an item of information that a person certifies as valid by applying one or more criteria, or tests, and (5) the findings of validated research".

A definition of knowledge is given by Horton (1979: 55) as ".. an organized body of information, or the comprehension and understanding consequent to

the acquisition thereof". Bell (1976: 175), the person responsible for the post-industrial (or information) society concept, defines knowledge as "a set of organised statements of facts or ideas, presenting a reasoned judgement or an experimental result, which is transmitted to others through some communication medium in some systematic form". He raises the point of many definitions of knowledge and stresses that these definitions are neither right nor wrong: It depends on their usage.

Berry and Cook (in Horton, 1979: 60) see knowledge as a higher level of information. Their work appeared in 1976 and 1977 and they write "...we suggest that the real resource which a department should be seeking to understand and extend is not just its data, but its knowledge" (Horton, 1979: 60 - 61).

Horton (1979: 61) does not agree with Berry and Cook's implication that knowledge is more important than information. He argues that data, information and knowledge is each important in its own right. Each one has its own unique contribution to make to decision-making. He agrees that it would probably be best for an organisation to develop "knowledge systems" as opposed to "information systems", provided they can afford the time it takes to develop these and having to get along without it while they have to wait for its development. Ehlers (1971: 184) also seems to disagree with the view of Berry and Cook and writes that information "is a much more comprehensive concept" than knowledge and one "which includes knowledge".

Ehlers (1971: 178) summarises the above definitions by offering two views when trying to define knowledge. These two views are:

- Knowledge as an attribute possessed by a person. In this regard, knowledge can be seen as "to be familiar with... to have experience of... to be able to recognize or distinguish... or to know that something or the other is the case" (Ehlers, 1971: 178). This view implies that the person must have been presented with something, presumably data or

information, before he could have become knowledgeable. It points to information being a component of knowledge.

- Knowledge as a special kind of information. The characteristics making information knowledge are that the information must be generally accepted as being true, that there must be certainty that it is true and that there should be adequate reasons for being certain of the truthfulness of the information (Ehlers, 1971: 178). This view introduces another concept, namely, that of truth. True information, presumably through validation and verification, becomes knowledge.

Taggart and Silbey (1988: 179) describe knowledge as "...data retained for reference with a potential use in future decision situations". Again they take the example "It is raining" (data), "It is raining and my car windows are open" (information) and "In many parts of the country spring is characterized by showers. Therefore, you should shut the windows when leaving the car in the parking lot" (knowledge).

Philosophers, going back to the days of Plato, have long been arguing about the concept of knowledge. General consensus is that knowledge is "justified true belief". It means that knowledge is "believing what is true and having sufficient reasons for it" (McInerney, 1992: 37). Three concepts are introduced in this definition, namely, belief, truth and justification and each one of these concepts has various deep and often conflicting underlying philosophical bases. Belief is something personal: It is how an individual portrays the world around him. In believing, one accepts that there are some facts in the world. That summer is hotter than winter would be an example of a belief. Beliefs are not absolute as one's certainty about them can vary. One can therefore believe more strongly in one thing than another. This kind of reasoning leads to all sorts of philosophical arguments such as the claim by the philosopher, Descartes, who said that if you can in any way doubt what you believe, you do not know it (McInerney, 1992: 42).

Beliefs can be true or false. The second component of the definition, truth, tests whether beliefs depict things as they really are. A belief would be false if it should depict things inaccurately. Truth therefore tests the accuracy of an account of the world. All theories concerned with truth admit that there are false and true beliefs, but differ widely in what makes true beliefs true and false beliefs false (McInerney, 1992: 39).

The third component is justification. Beliefs that are true do not add up to knowledge; justification is needed. Justification reveals *why* a person believes that a belief is true. "Knowledge requires that you have sufficient reasons or a justification for what you believe" (McInerney, 1992: 41). If one has good reasons why one believes that something is true, other reasonable people should be able to accept that, or be able to convince you that your belief is false. It comes back to the question of absolute certainty. Deductive reasoning should start from absolute facts, so-called "self-evident first principles" and then deduce everything from these principles. The search for these absolute truths led to Descartes' claim that the only thing to be certain about is that he exists, the famous *"cognito, ergo sum"* ("I think therefore I am").

Philosophers differ on whether knowledge requires absolute certainty. The "rationalist" philosophers, Descartes, Spinoza and Leibnitz support the theory that knowledge must be absolutely certain while others (empiricists), such as Locke, hold that it does not have to be absolutely certain and that very strong evidence is enough (McInerney, 42 - 43).

The above view of knowledge is strongly personal: It is what every person believes and consequently context and perspective play important roles. Philosophers acknowledge another kind of knowledge, called *a priori* knowledge. *A priori* knowledge is (true) knowledge that is not based on sense perception. Mathematical truths are good examples of *a priori* knowledge (McInerney, 1992: 56). *A priori* knowledge points to a non-personal kind of knowledge; 2 plus 2 always equals 4 regardless of personal beliefs, context or

perspective. Relativism, though, claims that all knowledge is relative to "worldviews" implying that even *a priori* knowledge must be personal.

Introna (1992: 2.37) argues that knowledge is generated from data (facts) by reasoning (as opposed to appropriating which leads to the generation of information perhaps using the same facts). Reasoning, according to his view, is logical and clinical; it is a-perspectual, a-historical and a-contextual. It does not even have to involve a human (although it normally will); a machine with the ability of creating knowledge, could hypothetically be produced. The process of generating knowledge is, according to Introna, objective and the investigator "explicitly 'removes' himself (his pre-convictions, fore-understanding and prejudices) from the investigation or reasoning process" (Introna, 1992: 2,38). This view seems to be strongly influenced by rationalistic thought which says that knowledge is attained by reasoning from self-evident first principles. The opposing view comes from empiricism which says that knowledge originates from sense and "inner" (ie. from within the mind) perception (McInerney, 1992: 43,44).

Where does knowledge originate from? We perceive (data) with our senses, put it in context, test it against what we already know and what is generally accepted as truths and we end up with information. This piece of information is added to our inventory of other information to be stored away until we find it necessary to retrieve it again. This accumulation of information does not happen without structure. Each new piece of information is put in its appropriate place, like the pieces of a puzzle. The collection of information which is believed to be true and can be justified, is called knowledge. To add to knowledge, we use existing knowledge and information.

Knowledge exists only in the mind and is therefore intangible. It is also something personal although a subset of it will be the same for almost all people: That which we all believe in, a body of collective knowledge. How we utilise our personal knowledge sets us apart from each other. This ability of how we acquire and apply our knowledge we call intelligence. Intelligence,

as we know, can vary widely from one person to the next. This is the reason why one person may be seen as more knowledgeable than the next person, although they may have access to the same information. What counts is the ability of a person to make meaningful connections and combinations between seemingly unrelated information.

Can knowledge be represented? The answer is yes, it has to be possible. Knowledge exists in the mind only and if it was impossible to represent it in some or other form, we would not be able to be informed. In order to be informed, we must be confronted with something. This something can only be experienced through the senses. In order for one person to inform another, the sender must represent the knowledge in his mind so that the receiver can receive something. Farradane (1980: 77 and 1979: 13) calls physically represented knowledge information. From the sender's side this seems right as it is data put into context and perspective by the sender, but can it also be described as information by the receiver? The answer is a conditional yes. It would be information to the receiver if he puts it into context and by adding perspective. Exceptions would be, for instance, where the receiver does not understand the language used by the sender. The receiver can only define that as data (meaningless attributes with the potential of having meaning).

Buckland (1991: 43) uses the terms information-as-process, information-as-knowledge and information-as-thing. A representation of information-as-knowledge is information-as-thing (and takes place during the process of information-as-process).

Returning to a definition for knowledge, the definition of the philosophers is accepted. The difference of opinions regarding absolute truths (rationalism vs. empiricism) is acknowledged without trying to resolve it here. *Knowledge is justified, true beliefs* and therefore, something intangible. It exists only in the (human) mind and can be represented in the form of information or even data. It is mostly personal (implying context and perspective) but certain knowledge can be non-personal and therefore a-contextual and a-perspectual, called *a*

priori knowledge.

2.2.4 Wisdom

Ehlers (1971: 179) describes wisdom as an attribute that some humans have. Such humans can pass judgements on, or draw conclusions from information. Wisdom depends on a person's imagination, understanding, honesty, humility and intelligence. He points out that more information does not necessarily lead to greater wisdom (or any wisdom at all). There is a strong relation between wisdom and experience: Wisdom is usually gained by experience and this is why "illiterate people may be called wise" (Ehlers, 1971: 180). The experience Ehlers refers to, relates to Introna's *Erlebnis* (lived experience) (Introna, 1992).

Introna (1992: 2.38) argues that wisdom uses information (derived from data through appropriation) and not knowledge, as its foundation. By using the hermeneutic circle, wisdom is gained by interpreting information, eventually leading to understanding and insight. A person with wisdom is able to make sound judgements. Judgement, he points out, is more than simply making decisions. Judgement uses insight and understanding and relates strongly to a particular situation. The ability to make sound judgements cannot be taught. Wisdom, according to Introna, seeks to understand the meaning of a situation. The interpretation process is strongly historical, contextual and perspectual. (Introna, 1992: 2.36).

From the above it can be concluded that wisdom is situation dependent. A person could be seen as being wise in one situation and illiterate or ignorant in another. However, for the situation where the person is seen to be wise, we can safely assume that such a person would be knowledgeable about the given situation. A person can never show wisdom in a situation if he has no information ("data put into context and perspective") or no knowledge ("justified, true beliefs"). It is, again, how such a person make meaningful connections between the information and knowledge he has available: A person with a "normal" ability to make such connections would be called "a

knowledgeable person" and one with a superior ability to do that, would be called a" wise person".

This explains why it is not possible to teach someone to be wise. Just as it is impossible to teach someone how to be more intelligent, that is, how to use available information constantly better, it is impossible to teach someone how to improve the ability to make meaningful connections and combinations of knowledge and information. You can either do it, or you cannot.

Wisdom is the ability a person has to combine the information and knowledge he has available to provide insight into a given situation. For someone to be wise, reasonable intelligence may be a prerequisite, but it requires no level of literacy nor any formal education.

2.2.5 The relationship between data, information knowledge and wisdom

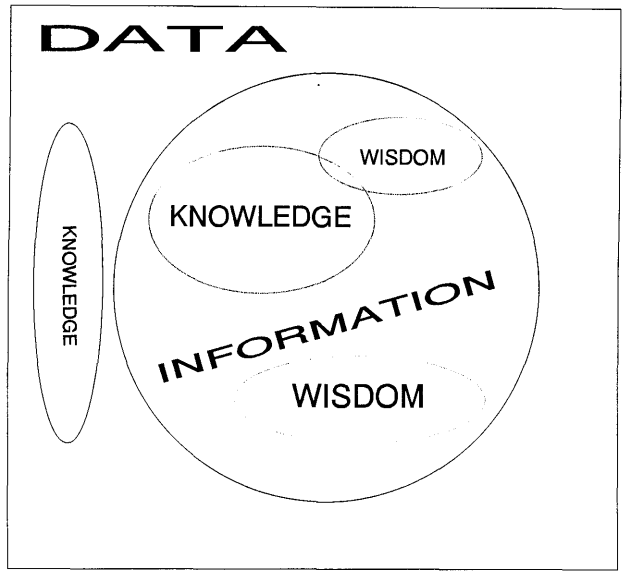
Data are attributes with no apparent meaning. This forms the universe set. Information, defined in terms of its component, data, is data put in context and perspective and therefore a subset of the data universe. Information, defined in terms of knowledge, is knowledge represented physically. Knowledge is justified, true beliefs. It can be based purely on data derived by reasoning and therefore non-personal, or it can be a subset of information derived through interpretation and therefore personal. It can thus be a subset of data or a subset of information. This relationship is depicted in figure 2.1.

Wisdom is the ability to combine information and/or knowledge to gain or provide insight into a given situation. It can therefore be a subset of knowledge or of information.

The problem with the terms data, information, knowledge and wisdom is that these terms are all used by laymen (and scientists) in common, everyday language. This, of course, leaves the term open to be used for a wide variety of phenomena; vulnerable to misuse. (This is where natural science has the

Figure 2.1

The relationship between data, information, knowledge and wisdom



advantage of working with concepts and phenomena not known to or understood by laymen thereby enabling scientists to define phenomena accurately.) Once data, information, knowledge and wisdom are defined, they loose the ability to assume different roles. This is like putting them into straight-jackets (Baily, 1984: 246) or giving rise to its "chameleon" character (Cronin, 1984b: 27).

In the study of information it would be more advantageous to use the terms suggested by Buckland (1991), namely information-as-process, information-as-knowledge and information-as-thing. He proposes the following:

Table 2.1

Four aspects of information

	INTANGIBLE	TANGIBLE
ENTITY	Information-as-knowledge (Knowledge)	Information-as-thing (Data, document, book, object, recorded knowledge)
PROCESS	Information-as-process (Becoming informed) Situational	Information processing. Data processing, document processing, knowledge engineering

Adapted from Buckland (1991: 6)

Information, according to Buckland, can be transformed from the one dimension to the other, as follows:

Table 2.2

Transformation of Information

	To: Intangible	To: Tangible
From: Intangible	Through thinking, reasoning (new information-as-knowledge; only by humans)	Through expressing (represented knowledge (information-as-thing); only by humans)
From: Tangible	Through perceiving (new information-as-knowledge); only by humans	Through information processing (new information-as-thing; possible to accomplish by using computers)

Adapted from Buckland (1991: 116)

The terminology suggested by Buckland is indeed useful. It provides the opportunity to escape from the connotation attached to the familiar terms data and information.

2.3 The Origin and Relevance of Information

The concept of information is as old as mankind itself. Immediately after man was created, God gave him information on what he could eat and what not: "You are free to eat from any tree in the garden; but you must not eat from the tree of the knowledge of good and evil..." (Disciple's Study Bible 1988: 7).

Looking at the interactions between man and his environment, information again plays a major, integrated role. A human being observes everything around him (data) and adds to his composite knowledge. This knowledge is then utilised to create a man-made universe consisting of machines, organisations, etc. and to manage and control his own activities as well as the environment. There is a constant interaction taking place between man, the environment and other human beings by means of organising and controlling, in the process contributing to the composite knowledge of mankind. "The activity control is reflected by the social, political, and economic forces which keep society in motion. In all of these interactions information is involved" (Otten, 1974: 93). Information is therefore an integral part of man's existence.

Checkland and Scholes (1990: 2) take this argument further and state: "Mankind finds an absence of meaning unendurable". In order for man to find meaning, he needs to find answers to many fundamental "unanswerable" questions. Based on what we see and experience, we interpret and form "intentions" as they call it; another unique characteristic of man, according to Checkland and Scholes.

It is therefore not surprising to find that, from the earliest times, man has been collecting information about himself and his environment. The Sumerians were already recording information in the year 5000 B.C. and the event of the first book-press in the 15th century is seen to be one of the major events in world history. According to Toffler (1979: 37), at that time, new titles were published at a rate of 1000 per year in Europe. In 1950, that is, four and a half centuries later, this figure stood at 120,000 per year and in the 1960's,

worldwide, 1000 titles were being published per day. "On a worldwide basis, scientific and technical literature mounts at a rate of some 60,000,000 pages per year" (Toffler, 1979: 38). Benjamin (1987: 30) and Naisbitt (1984: 24) claim that the available data double every twenty months and Cronin (1985: 5) claims that "the US Federal Government collects more than 130 billion items of data per year".

The invention of the electronic computer around 1950 brought with it new possibilities as far as the processing of data, including text, was concerned. Suddenly it was possible (though not very practical but at least possible in principle) to manipulate enormous amounts of data. The dissemination of the available information became a reality. This led to masses of data being collected in databases. Cronin (1985: 5) claims that in 1985, 2000 databases were commercially available, containing more than 80 million records and growing at a rate of 8 million per year.

The advent of the computer brought with it the birth of the "Information Revolution" and the gradual end to the "Industrial Revolution". Where the shift from the agriculture society to the industrial society took 100 years, the shift from an industrial society to an information society only took two decades (Benjamin 1987: 30). In a lecture delivered during 1986, Cronin (1985b: 129) made the point that the world has not yet become an information society, but that the signs indicated that it was evolving towards an information-conscious society.

Organizations have also been affected by changes that were taking place throughout the Western world since the 1970's. The need for information increased together with these changes. Organisations grew in size as a result of internal growth as well as from takeovers and mergers. This trend was particularly visible in the motor, aviation, computer and chemical industries where fewer, but much larger firms became evident. Tricker (1982: 22) quotes British Leyland's merger with Honda, the Concord and the Airbus as examples of this trend.

This increasing scale, together with the internationalization of the business, calls for new and innovative organizational structures and places a much bigger emphasis on information. "A diagram of communication and data channels in a modern organization ...is more likely to resemble a plate of spaghetti than a neat organizational pyramid" (Tricker, 1982: 23). The executive of such a firm is faced with the problem of having to take far-reaching decisions. These decisions cannot be taken without the necessary information at the disposal of the executive. As a result, the executive needs the support from a variety of information systems simply because he cannot monitor this complex situation on his own.

It is not only organisations that undergo change. Everything around us seem to be changing. The rate of change also seems to accelerate. The speed and range of mass communication, the speed of travel, the rate at which energy is consumed and even the population growth seems to be taking place at a faster rate (Toffler, 1979: 31 - 37). We are living in an information-rich era. Information, in a generic sense, seems to be all around us. Toffler (1979: 157) indicates that the average American spends, on average, about 52 minutes every day reading his newspapers. That same person listens to the radio for an hour and a quarter and sees about 560 television advertisements. Of these he only notes 76. The rest is "blocked out".

The greatest creation of man, according to Tricker (1982: 40) is the spoken and written word. This ability differentiates him from animals which communicate visually and by the simplest vocabulary of sounds. Being human means being able to convey information by means of language. Language enables man to record his past and imagine his future. Being able to handle information of greater complexity, of higher levels and with greater interconnectedness, enables man to evolve to bigger achievements. The ability to capture, store, transmit and retrieve data offers the potential for higher orders of human relationship between individuals, organisations and societies (Tricker, 1982: 40).

The modern organisation has no option but to rely on its information systems to be able to absorb the changing environment in which it functions. The information system emerges as one of the core information sources of the organisation. Therefore, "the potential for crises, even catastrophe, is significant; so is the opportunity for increased efficiency and effectiveness" (Tricker, 1982: 41).

White (1987: 3) stresses this point when he writes about knowledge as "...the most valuable commodity... Information is the ore from which... we can extract knowledge... Knowledge is the only antidote to ignorance and its attendant evils, poverty and disease". Likewise, Jacob and Rings (1986: 119) write this about information: "Information is integral to all living organisms. How we use that information determines how we live and function and how our societies evolve". Van der Merwe (1986: viii), in a book on computers and the law, writes: "...I argue that information be recognized as one of the most valuable assets in this century and that it should be correspondingly protected by the law". Tom Peters in his book "Liberation Management" (1992: 110) describes organisations as "information processing machines". He even claims that "All economics is information processing" and bases his statement on the fact that it is of vital importance for any business to be in instant touch with its customers: What they want, where they want it, etc.

Information is the fuel of the intellect. Every individual needs it and no business can survive without it. It is only when we stop to think about it when we realise the role information plays in our everyday lives. From our earliest days we collect information about ourselves and our environment and have grown so used to it that we do not give it a second thought. Most of the time we take it for granted. We treat it in the same way we treat oxygen.

Businesses thrive on information. Without it it grinds to a halt. Information is the lubricant of society and of business.

2.4 The Life-Cycle of Information

Horton (1979: 53) contends that any fact has a certain "life-cycle" (bearing in mind that a "fact" roughly equates to data). The four stages of its life (based upon the work of Claude E. Shannon) are as follows:

- Stage one is the "birth" of the fact. At this stage this fact has almost no significance standing alone, out of context. It is a "raw fact" and thus unevaluated. An example of this is for instance a number. A number has almost no meaning on its own and will remain so unless there is a context within which or against which to ask a question.

- Stage two is when the fact grew because someone chose to evaluate the fact by placing some interpretation or meaning to it. This is why information is often referred to as evaluated data.

- Stage three is when the fact reaches "maturity". This occurs when various bits and pieces of information are put together in an even broader context. By adding one's own knowledge to this information, it is possible to move from mere opinion or half-truth to "truth". "It helps us point to principles, and it helps to add to a body of doctrine" (Horton, 1979: 53).

- Stage four is the possible death of the fact which happens when its identity and relevance are completely subsumed and submerged in the knowledge base.

Shannon (in Horton, 1979: 53) and Simon (in Horton, 1979: 54) both developed theories on the nature of information, based on the life-cycle of a fact.

There is a distinct similarity between the life-cycles of Horton and the differences between data, information, knowledge and wisdom. Stage one may be equated to data, stages two and three to information or even wisdom whilst stage four may also be looked at as knowledge ("true beliefs"). It may

therefore be useful to look at data, information, knowledge and wisdom as a growth or evolution of a concept, fact or attribute.

Cronin (1985c) points out that information has, in fact, multiple life-cycles; information which is of little value today may be of critical importance a number of years from now and vice versa. This points to the timeliness attribute of information. Cronin's view of the life-cycle therefore points to variations in its value. This is different from Horton's view which is based on the evolutionary stages a fact goes through although implicit in Horton's view there is also an element of value.

Burk and Horton (1988: 11, 19, 30) also refer to the life-cycle of information as one of the models of managing information. They list the following as the life-cycle:

- information requirements definition
- creation, acquisition or collection
- transmission
- processing
- storage
- retrieval
- dissemination
- use and re-use
- disposal.

This view refers more to activities rather than a life-cycle in an evolutionary sense. It does not offer much as in between the creation and the disposal, anything can happen to the "information", or nothing at all. It does not have to go through any of the "stages".

We can conclude that information (in a very generic sense) passes through various stages starting with its creation and ending with its disposal or purging. Important to note is that during these stages, value may be added to the information. It does not have to go through all the stages and there is no limit

to the time that it spends in one stage. Information that has been purged at one point in time may be "resurrected" again at a later stage and may, in fact, go through some of the stages again. The life-cycle is therefore not linear; it is more cyclical in nature.

What is important to note is the timeliness concept. This is of specific importance when looking at the management of the information which is covered later on.

2.5 The Dimensions of Information

2.5.1 The Resource Dimension

The general perception of information as a collection of data, facts, ideas, or knowledge, implies that information is a resource, although not always something physical. The Commission on Federal Paperwork (in Horton, 1979: 11) recommended to the US Congress in 1977 that information was to be treated as a economic commodity. Scharf (1984: 40) and Braunstein (1981: 9) also accepts that information is a commodity. Vickers (1985c: 152) writes the following: "The notion that information is a resource is becoming quite widely accepted in certain circles, as evidenced by the spate of pronouncements on the subject by various gurus in the management, data processing and information science journals; in government publications .... and in the national press".

Otten (1974: 97) is convinced that information can be seen as a commodity: "...it can be transported (communicated from/to) or altered (processed by) ...be produced (generated by) and lost (in the process of communicating or processing)." When information is viewed as a resource, time does not play any significant role. He does, however, point out that there is no way of "directly or indirectly" measuring this commodity, thus paving the way to clearly differentiate between the properties of information as a resource and the properties of other resources.

The resource dimension refers to information-as-thing and information-as-knowledge. It includes therefore both the tangible and intangible forms of information.

2.5.2 The Process Dimension

Not everyone agrees with the view that information is a resource. Carlson (of IBM) (1980: 6) states categorically that information is not a resource. Vickers (1985c: 152) finds that people believe that if you cannot hold something in your hand, then it is not real and, therefore, not a resource. The question emerging from this line of thought is: If information is not a resource, what is it then? Is it just a concept? Carlson (1980) does not give an answer, but others feel that information can be treated as a process.

The process referred to is the process taking place when a change occurs in a person's knowledge of something. Wilson (1985: 62) points out that this change, however, can only take place when the person has been presented with some information (the "stuff") and notes: "...no benefit can occur unless some useful change in the state of knowledge of the [receiving] person occurs" (Wilson, 1985: 62). Buckland (1991) uses the term information-as-process to refer to this dimension of information.

When information is viewed as a process, time is important: "Information received at one time can be no information at another time" (Otten, 1974: 97).

Horton (1979: 59) suggests that we think of information both as a process and as "stuff", i.e. "Information, then, is both a process which incorporates the objectives, values, logic and perceptions of the individual and a series of objects in the form of data elements, records, reports, files and messages which are an integral part of the process by which the individual collects, stores, transmits and communicates symbolic data that has meaning or value to the person".

This view implies that the individual describes, understands and interprets the real world through the use of symbols. Individual information processing, therefore, implies the use of symbols and this use of symbols presents one of the root causes of information problems. The way these symbols are organised, conceptualised, presented and are given meaning to, must have an important bearing on the effectiveness of decision-makers and problem-solvers (Horton, 1979: 59).

This view strongly correlates with the views taken by the field of semiotics. Semiotics is the study of a culture as a formal system of signs and therefore views information as the process of communication. The analysis of the process of communication takes place on four levels. The pragmatic and semantic level focus on the contents and purpose of communication whereas the syntactical empirical levels focus on the way and form of communication (Liebenau and Backhouse, 1990; Stamper, 1973).

Wilson (1985: 62) also feels that information must be viewed as both resource and process: ".... it is necessary to think of information as both stuff and process". Otten (1974: 96) calls these two dimensions the static (resource) and the dynamic (process) concepts of information. Buckland (1991) refers to information-as-process and information-as-thing to distinguish between the two dimensions.

Langefors (1993: 150), in his Infological Equation, clearly identifies a process, but also part of his equation is data, which could be viewed as a resource.

2.5.3 Other dimensions

Debons et al. (1988: 2) identify two other dimensions, namely, information as energy and information as communication. The energy dimension is argued by pointing out that the sound waves of an approaching train provides one with information. The communication dimension points to messages flowing from one person to another during conversation (semiotics). These two dimensions,

however, are both pointing to messages being transmitted and received by means of sound waves with the result that they must be one and same dimension. It is felt that they are already included in the above two dimensions (resource and process).

It is clear from the above that information has one dimension pointing to something physical or conceptual (the resource or commodity dimension) and another dimension pointing to something taking place inside the mind (the process of informing). When referring to the resource dimension, it is important to realise that knowledge, even though intangible, is also included and that it is not restricted to something physical. When evaluating how information should be managed, a particular challenge presents itself, namely, how to manage the intangible part.

2.6 Characteristics of Information

Cleveland (1982: 34) lists the following characteristics of information:

- Information is expandable

  As information is used more and more, more information is added to it, resulting in a growth. There is no limit to this growth and this introduces the problem of information overload: Too much information. The only limiting factors are time and capacity: Time available to humans to analyse and use information and capacity of people to analyse and think integratively.

- Information is compressible

  Paradoxically, information can also be compressed, that is, summarised and concentrated for easier handling.

- Information is substitutable

Cleveland mentions robotics and automation in factories replacing workers and therefore causing a transformation of the workforce. Toffler (1990: 88) and Bell (1976: xiii) claim that information is replacing capital.

- Information is transportable

  "Bits" of information can be transported at the speed of light. Verbal communication takes place at the speed of sound.

- Information is diffusive

  Information tends to "break out of the unnatural bonds of secrecy in which singleminded people try to imprison it" (Cleveland, 1982: 37). Information seems to influence the environment around it, spreading when leaked.

- Information is shareable

  Things are exchanged, information is shared. If an idea is shared by two people, they both have the idea. (It is "...like a good kiss: In sharing the thrill, you enhance it" (Cleveland, 1982, 37)).

Economists identified certain characteristics of a market commodity which may lead to problems and even market failures. The attributes that describe information and often give rise to market failures are, amongst others, the following:

- Simultaneity of ownership, i.e., more than one person may own the same "bit" of information.

- Indivisibility, i.e., half an idea is worth nothing.

- Nondepletability, i.e., when an idea is sold, the seller still has the idea for himself.

- Uncertainty and risk in transaction, i.e., the seller has to tell the buyer what the idea is before the buyer can decide if he wants to buy and then the buyer may not want to buy any more because he already knows what he wanted to know (Braunstein, 1981: 10-11).

It is clear that information has certain unique characteristics. Compared to the other resources, namely human, financial, natural and material resources, the information resource is the most difficult to grasp. From an information management point of view, these characteristics are of paramount importance. They need to be taken cognisance of if information is to be managed properly.

2.7 The Purpose of Information

Introna (1992: 2.11) writes that the purpose of information is to effect change in the recipient of the information. Why would it be necessary to effect change in someone else? The reason for this is to be found in the nature of the human being. A fundamental characteristic of being human is, firstly, to survive and, having achieved that, to search for meaning. In order to survive, we need to be informed: What to eat, what animals are dangerous, how to find food. Searching for meaning means observing the world around us, but also to share ideas with others of the same kind. This cannot be done without information flowing between individuals.

Habits, tradition, customs and knowledge are passed on from generation to generation. As human beings we want to express ourselves. This is impossible to achieve without information.

The purpose of information is therefore to share with others and, as an integral part of the process, to gain more information and knowledge. Information and knowledge kept to oneself, is to be selfish. (Although this argument sounds

very logical, people often behave differently. This issue will be explored further in chapter 3, section 3.5.7.) Furthermore, information must trigger some action, either in the owner of the information or in the recipient. Information needs to be productive and not only informative.

2.8 The Uses of Information

As was pointed out in earlier sections 2.3 and 2.7, information plays an integral role in our everyday lives as well as in business. We use it to be informed about many things - from the mundane to the most complex. The same person who spends his working day doing the most complex mathematical computations, may spend his evening watching a fiction movie.

In the business world, decisions are taken based on information. The "better" the information, the "better" the decision ought to be. Having the necessary information regarding its competitors, one business can put the other out of business. Information is the lifeblood of a business: Without it, it is doomed to failure. Careful attention should, however, be given to the kind of information needed in a business. A common mistake (often made by information systems professionals) is that all information must necessarily be structured (quantified) information in order to be useful.

McKinnon and Bruns (1992: 15) undertook an interesting study in the USA to determine, *inter alia,* what information managers need and where they (really) get such information, and proved that the formal accounting systems were "more frequently than not" not the primary source of managers' information. They found that "...successful managers develop the ability to collect and use diverse, ambiguous, and sometimes contradictory information effectively and efficiently". They conclude that the MBLN - Management By Little Notebook - had not died as many would have wanted to believe.

Governments are both creators of data and information and users at the same time. Selective releasing of information to its citizens may put it in a powerful

position, leading to the argument that "information is power". Having the necessary information wins wars and gives comparative advantage in negotiating fora.

The uses of information will be explored more fully in chapter 3 when information is analysed in different contexts.

2.9 Disciplines related to Information

2.9.1 Information Theory

The term information theory (or theory of communication) is sometimes used to refer to the work of Norbert Wiener (1948) and Shannon and Weaver (1972) on the mathematical theory of communication. (They originally published their findings in 1949.) It concentrates on three "levels" in the communication process, namely, (i) how accurately symbols of communication can be transmitted (the technical level), (ii) how meaning is conveyed (the semantic level) and (iii) how effectively received meaning affect conduct in the desired way (the effectiveness level). They do this by using a model of a source with a transmitter, a destination with a receiver, the channel between these two and noise coming from other sources and interfering with the signal on the channel.

The technical level (transmission) can be expressed in great detail using mathematics. In this regard Warren Weaver did excellent work to show mathematically how noise, for instance, can affect the channel. The semantic side, that is, the meaning of the message and how it compares with the intended meaning on the source's side, is more complicated. Shannon acknowledges this and says: "This is a very deep and involved situation..." (Shannon and Weaver, 1972: 4). Weaver acknowledges the semantic side, but then chooses to ignore it: "[The] semantic aspects of communication are irrelevant to the engineering problem" (Shannon and Weaver, 1972: 31).

2.9.2 Information Science

Information science concerns itself with the study of communication of information in society (Vickery and Vickery, 1987: 1). It studies all the processes involved in generating, use and transferring information from sources to recipients (users) and addresses the following:

- The behaviour of people as generators, sources, recipients, and users of information, and as channel agents;
- The quantative study of the population of messages - its size, growth rate, distribution, patterns of production, and use;
- The semantic organisation of messages and of channels that facilitates their identification by sources and recipients;
- Problems particularly associated with the functions of information storage, analysis and retrieval;
- The overall organization of information systems and their performance in transfer;
- The social context of information transfer, in particular its economics and politics (Vickery and Vickery, 1987: 12).

From the above it is clear that some other disciplines are drawn into the information science term, namely, library science and computer science. Debons (1985: 66) argues that library and information science belong to the same corpus. The higher level, or meta level, is the knowledge environment.

In a later article, Debons *et al.* (1988: 12) write: "It is clear ...that the major areas of interest of information scientists lie in the logistical (acquisition, storage, and retrieval) properties and requirements of knowledge". It is founded upon the disciplines of philosophy, mathematics, linguistics and behavioural science.

It is clear from the above that information science addresses the same issues as information theory with the difference that information science does not

approach it from an engineering (mathematical) angle. It views it as a social issue. A part of the information science discipline is library science and, to a lesser extent, computer science. Both library science and especially computer science, have their own specialist fields, but in total, they all belong to the same corpus: The knowledge environment.

Information science is very relevant to the concept of information management and makes an important contribution in understanding what information management is. It tends to focus more strongly on the *content* side than on the *conduit* side.

2.9.3 Computer Science

Computer science concerns itself primarily with computers and operating systems. It recognises however, that the purpose of these is to manipulate data into, what is ordinarily called, information. It therefore has to touch on the terms data and information, but it not necessarily in a great amount of detail.

Rice and Rice (1969), in a book on computer science, deal very briefly with the concept of information by acknowledging that they do not try to define it precisely. They write: "We simply feel that [information] is something abstract that does not have any physical existence". This reference to information by Rice and Rice is remarkable in the sense that, by saying that it does not exist physically, they clearly recognise that information can never be created by computers. It has the implication that is only exists in the mind, presumably as knowledge.

Although this is rather unsatisfactory from a definition of information point of view, it must be understood that computer science is more interested in the "how" rather than the "what". In contrast to information science, it focuses on the conduit rather than the content.

2.9.4 Information Systems

An information system is generally understood to be a system to provide management and others with information they need to do the tasks they have been assigned. Although such a system does not have to be computerised, most information systems used in business are. Even computerised information systems will always have elements of manual procedures as part of the overall system. Davis and Olson (1984: 7) sum it up: "...some tasks are best performed by humans, while others are best done by machine."

An information system is essentially a mechanised representation of the real world. To successfully develop and implement such a representation is not easy. Various ways have been invented to "translate" the real world - usually users' requirements - into a mechanised system. Information mapping or information modelling is one such way. Information modelling can be approached from at least two views: The Reality Mapping view and the Formal Language Development view (Lyytinen, 1987: 9). The former "concentrates on the completeness, predictability, and consistency of the [information systems] design", whereas the latter "concentrates on the nature of human communication and sensemaking" (Lyytinen, 1987: 17).

Generally speaking, an information system processes data in order that humans can transform such data into information, leading to a state of awareness of the environment. It usually involves a combination of "persons, machines, and procedures that augment human biological potential to acquire, process, and act upon data. It thus improves our chances for survival" (Debons *et al.,* 1991: 9). It is important to realise that an information system cannot produce, generate or create information. Information, according to the definition, is data put into context and in perspective. Only a human can do that. Introna (1992) uses the term "appropriation". Again machines cannot do that on behalf of a human.

What is possible for a machine to do is to produce an information *product* (such as a report), thereby producing an information *resource*. But even this

process is impossible without a human having "programmed" such a machine beforehand.

Semiotics, the study of analysing signs and how they function, is very relevant to information systems. Semiotics concerns itself with the process of informing; in transmitting a signal from a sender to a recipient and having the objective of getting a message across as clearly as possible in order for both parties to understand. Semiotic analysis provides useful diagnostic tools to analyse problems associated with information systems. It does the analysis with respect to the meaning, form, content and purpose of the message. The problem can therefore be defined at the correct level and fixed on that level without interfering with the others unnecessarily. "The semiotic approach to analysing information systems is robust and independent of any particular technology. Instead, because it is based upon the way people use signs, it can come close to capturing the full range of properties" (Liebenau and Backhouse, 1990, 17).

A term often used is management information system (MIS). There is little difference between a management information system and an information system although, generally, the management information system is aimed more at providing information to management rather than lower levels of the organisation. Davis and Olson (1984: 6) define an MIS as "...an integrated, user-machine system for providing information to support operations, management and decision-making functions in an organization. The system utilises computer hardware and software; manual procedures; models for analysis, planning, control and decision making; and a database".

What is important is that an information system can never be and should never be viewed as something technological only. There is a strong sociological side to an information system which must not be underestimated. Lyytinen (1987: 17) writes: "Information systems development is both a social and cultural change that is carried out in relation to introducing information technology". Not only is that true for the design and development phase of an information

system, but it is especially true for its implementation phase.

Going back to the definition of information, namely, that it is data put into context and perspective, it is clear to see that a machine, or the procedures of a manual system, can never put data into context and perspective: Only a human can do that for himself. Transforming data into information can therefore only be done when a human is involved; when information-as-thing becomes information-as-knowledge. Information systems designers often overlook this "human" side of information systems and concentrate on the technical side, only to be totally surprised when the systems is not successfully implemented.

The study of information systems is important to information management as the two are interrelated. Information management will always involve information systems in some way or another. Successful implementation of information management requires an in-depth understanding of information systems, especially the social side thereof. The importance of a good understanding of information and its relation to data and knowledge to the field of information systems is evident in the work of many authors on information systems. In this regard the work of Langefors (1993) and Lyytinen (1987) can be mentioned.

2.9.5 Information Technology

Information technology refers mainly to computer technology: Hardware and software. Because of the close relationship between information systems and information technology, it is important to take note of technology when addressing information management. Peters (1992: 11) writes: "The computer is the locomotive of the Information Age." By this he means that information technology has been the enabler of the information economy and society; without the developments in information technology and the convergence of related technologies, such as telecommunications, the growth of the information economy would be impeded.

Otten (1984: 17, 23) uses the term information tools to refer to information technology. This is what supports the information work. The support function is, of course, important as, without it, the information work would become impossible to a large degree. Yet, it must not be seen as an end in itself; it is only the means. Otten distinguishes between data manipulating and information processing technologies (note the plural). The data manipulation technologies are concerned with data and its form of representation (print, image and speech) and therefore not with content. Information processing technologies concentrate on content and not the form; they are used to transform "input data into output data" and therefore add value to information (Otten, 1984: 18). They become artificial extensions of human capabilities. Otten argues that the individual who is in full control over these technologies has a competitive advantage in the labour field while those who fall behind may even become obsolete (e.g. a typist who cannot use a word-processor). Likewise, businesses which are in full control of technologies gain competitive advantage. For business this implies for information to be regarded as a resource. The same could apply on a national level (Otten, 1984: 19).

Many writers equate information technology and information systems with information management. A good example of this is the book by Duffy and Asad (1980), *Information Management*, in which just about the entire book is devoted to the development of information systems and the management of information technology. Another example is the book by Paul L. Tom: *Managing information as a corporate resource*. The very last sentence in the book says it all: "It is important that all the computer hardware fit together to contribute to the overall goals and mission of the corporation. *That needs corporate management of the company's information resource*" (Italics added) (Tom, 1987: 308). This clearly indicates that the author holds the view that the information resource consists of the computer hardware only.

Of course, information technology plays a very important role in information management, as will be later explored more fully, but is but one of the components of information management. It provides the necessary information

infrastructure for the information management, but is not information management itself.

2.9.6 Conclusion

It is clear from the above that information falls within the domain of many and varied disciplines. Each one of these disciplines has a justified claim to information as one of its focal points, but this often leads to a definition of information suited to that specific discipline. This is the reason why information is perceived and defined differently by computer scientists, librarians and communication scholars. What is clearly called for is an holistic approach. An approach which does not aim at a specific discipline, but one which takes the different approaches into consideration.

2.10 The Cost of Information

It is argued by Horton (1979: 57) that information can be viewed (in an economic sense) as a commodity. That immediately introduces the concept of selling and buying of information. For a market to exists, the commodity must have a value to the buyer and a cost to the seller. Marchand *et al.* (1986: 212), however, point out that information is not an ordinary commodity - it can be sold without a loss of ownership and, what is more, it does not get depleted. Information products, though, are sold on a daily basis; newspapers and books, for instance.

It was pointed out that information is a product obtained when data are converted through a process of adding context and perspective. In order to obtain the product called information, it will be necessary to collect or generate data and then to put it through a process of data manipulation using technology, or doing it manually, or both. Such a process implies that a cost is involved. Each additional element of data carries a marginal cost although this cost usually does not increase in a straight line as manpower or computing facilities are added to acquire and manipulate that data element.

The moment that the data become information implies that someone found the data useful and it therefore acquires a value. This does not mean, however, that data do not have, at least, a potential value or that information does not have a cost. Data, like water in a reservoir waiting to be sold, have potential value. Data may even have a real value: Someone may buy raw data in order to extract information from it. The cost of information is found in the cost of the resource used to obtain the information: The data.

The value of the information to the user follows an inverse exponential curve. If the user knows nothing of the subject, each element of information reduces his uncertainty considerably and it will consequently have a high marginal value over the cost. As the user learns more, each element of information adds less to his knowledge base until new data add nothing more and might even confuse him (Tricker, 1982: 34 - 35).

Costing or pricing information and the valuing thereof are not simple matters. Information, as was shown, lies on a continuum ranging from something tangible (information-as-thing) to highly intangible (information-as-process and information-as-knowledge). If we define information as the process of increasing knowledge then we must agree with Wiener (in Tricker, 1982: 35) who writes: " ...information is what changes us. It is not a commodity to be bought and sold".

2.11 The Value of Information

By looking at information and the role it plays in decision-making, one can conclude that the value of information must be closely tied to the decision made with that information as basis (Carlson, 1989: 7). This view implies that information cannot possibly have an absolute universal value. "Its value is related to who uses it, when it is used, and in what situation it is used" (Ahituv and Neumann, 1982: 50). Farradane (1986: 14) does not look at the receiver of the information to determine its meaning. He looks at the originator and writes: "The only valid meaning must be sought in the

originator's thought". Likewise, Hoffmann (1980: 291) shows that the information content of a document can be qualitatively determined by just looking at what is written in the document, that is, without taking into consideration what effects the information may have on the receiver.

To determine the value of information in a given situation, Ahituv and Neumann propose three techniques:

2.11.1 The normative value of information

According to the *normative value* of information, the nett income which may be realised is calculated by subtracting the expected income without the information from the expected income with the information, that is:

a = b - c,
where
a = Nett expected income,
b = Expected income *with* the information and
c = Expected income *without* the information.

The normative value of information is derived from decision theory and is also sometimes called information economics. It has a high degree of probability as its base. Also underlying the theory is that there is some preliminary knowledge available about the occurrence of the events. This knowledge is then utilized to assign to each event an a priori probability, either objective (such as tossing a coin) or subjective (such as predicting a winner of a sports match). Additional information is fed into the model and the nett income then calculated (Ahituv and Neumann, 1982: 51).

It is clear to see that this technique is very individual-oriented. An extension of this technique, called the team theory, is sometimes used and takes into consideration the views of groups of people to determine its value.

2.11.2 The realistic value of information

It has already been pointed out that information forms the base for taking decisions. Decisions trigger actions and actions affect the achievements of the information user (which, in this case, could be a person or an organisation). If we can therefore measure the differences in achievements, the impact of information can be determined. The common term for achievement is performance, and the measured difference in performance, due to informational factors is called the realistic or revealed value of information (Ahituv and Neumann, 1982: 56).

This technique offers significant advantages over the normative technique. Firstly, it is not necessary to know the probabilities and strategies and to formulate a mathematical model. The information-processing/decision is therefore treated as a "black box" into which the inputs are fed and out of which the outputs are measured. Because the outputs are measured, rather than calculated, the model has a second advantage.

Performance can be measured in terms of profitability, response time or accuracy of reaction and although it might still be difficult to relate changes in output directly to changes in information (the input), these can be overcome (Ahituv and Neumann, 1982: 56).

The third advantage is the fact that this technique takes into account human factors related to perception and preferences as well as the technical characteristics of the information system. The normative technique is furthermore sometimes criticised because of its basic assumption that human beings act fully rational and wish to optimise. Simon (in Ahituv and Neumann, 1982: 57) claims that the normative technique uses satisficing rather that optimising. The realistic model incorporates this idea because it measures what is achieved instead of what should be achieved.

A disadvantage of the realistic value model is that it could be expensive to set

up an experiment and sometimes difficult to have an experiment similar in all respects to the real situation. If these can be overcome, however, this model provides a good way of determining the value of information.

2.11.3 The subjective value of information

This technique takes into account a person's impression of the value of information. Individuals are confronted with alternative outputs (such as reports) and their opinions asked, usually to rank the alternatives, or to designate their satisfaction on a scale, or to estimate how much they are willing to pay for the report (Ahituv and Neumann, 1982: 57).

Ahituv and Neumann (1982: 57) point out that this technique is used quite frequently in our everyday lives. When the price of a newspaper is increased, we reconsider whether we are still willing to pay the new price. At some stage the price asked for the newspaper will be higher than the value of the information if the price is continually increased. This price is then our subjective value of the information.

Ahituv and Neumann (1982: 58) quote several problems with this model. Firstly, it is based on the subjective values of individuals. Totally different values could, therefore, be obtained should key personnel change. Secondly, to put a monetary figure to a scale rating of, say 1 to 7, is difficult to do (and again subjective) and having done that, it is hard to decide between systems when system A is graded 4 (with a value of, say, R20,000) and system B is graded 4.5 (with a value of R25,000). The third problem is that the subjective value is *ex post,* that is, the value can only be determined *after* the information is available. To get the information to be available might sometimes be a costly process in itself.

If we accept that information can be treated as a commodity - even though it might not be " ...a commodity like any other" (Scharf, 1984: 39) - then a market for information must exist. This is indeed the case as proved by Cronin

(1985: 5), claiming that in 1985 there were already 2000 databases available on a worldwide basis. The selling of books and specifically textbooks, is also nothing but the selling and buying of information.

The nature of information is again such that its trading is often problematic. Once information is sold to a customer, that same customer may sell the same information to a third party. Depending on the price paid by the first buyer, his price to the third party may be less that what the original seller asked. "This has become a real problem in the information field where there are examples of producers of information competing against their customers for additional buyers" (Braunstein 1981: 11).

Another problem with the trading of information is that it is not easy (if at all possible) to determine what the value of the information is before it is known to the buyer what the information is. That is, the buyer cannot make an accurate judgement on the basis of part of the information. "And if I did have perfect information about what was offered for sale, I would no longer need to purchase it" (Braunstein, 1981: 11).

The view that information does not have absolute value is not uncommon to other commodities. The value of a glass of water differs between someone who has lost his way in the Sahara desert and the value it may have to someone who lost his way in an arctic desert. The same applies to the value of knowing the results of a horse race. It depends on the person (whether he is a gambler), the time (before or after the race) and the situation (whether the bookmaker is accessible) (Ahituv and Neumann, 1982: 50).

Valuing information is not a simple matter. Marchand and Horton (1986: 212) write: "No topic is more complex that the one of finding useful ways to measure the value of information products... and of determining their costs".

2.12 The Information Quantity

When considering economic commodities and services, it is customary to define the entity and then some unit of measure of the entity. This is necessary to determine the value of the entity per unit. When the entity under consideration is data, its representation is letters and digits. It is possible to quantify this, for example, by counting the number of characters, number of words or the number of sentences. This, however, does not give any indication of the meaning of the letters or figures. With data and information it is therefore not possible to do any kind of evaluation before the user and the situation in which the data are used is also identified and taken into consideration (Ahituv and Neumann, 1982: 59).

Characters, digits, words and sentences are therefore all valid measurements for the quantity of data, but clearly not indicating the meaning, neither to the recipient, nor to the originator. There is another measurement, called the entropy function, which attempts to go one step further by taking the meaning into consideration.

Langefors (1993: 114 - 129) introduces a concept he calls an information element. He writes: "An information element is the knowledge of something elementary, or simple, about an (identified) object" (Langefors, 1993: 115). He then identifies elementary messages (e-messages), elementary sentences (e-sentences), data records and information about information (meta-information) in order to design a model to be useful in information systems design and development. The e-message provides a way of structuring information (Goldkuhl, 1995: 63).

The entropy function has its origin in the study of thermodynamics and serves as a measure for the degree of disorder in certain states of nature. Shannon and Weaver (in Ahituv and Neumann, 1982: 59), suggested a method to adopt this function in communication and information theory. In the case of information, the entropy function is used to determine the quantity of information that

is necessary to reduce uncertainty.

The general equation for entropy for numerous events, n, whose probabilities of occurrence are $p_1,....p_n$, is:

$$H = - \Sigma p_i \log p_i$$

H can assume values between 0 and 1. H = 1 indicates complete uncertainty (e.g. the toss of a coin) and H = 0 indicates complete certainty. If the entropy is calculated in this way, and the result is zero, no information has to be transferred, or as Ahituv and Neumann (1982: 61) put it: "...you do not have to transfer information if everyone knows what is happening".

The entropy therefore supplies us with a handy technique to quantify information in such a way that the meaning of the information is also included in the unit of measurement. It assumes though that the information can be used to reduce uncertainty for the recipient of the information. Farradane (1986: 14) does not agree with this assumption. He writes that one cannot look for the real meaning on the side of the recipient. "The only valid meaning must be sought in the originator's thought" (Farradane, 1986: 14).

As was shown earlier in section 2.2.2.1, Hoffmann (1980: 291 and 1982: 134) worked on the determination of the information content of documents. His definition of information is that information is a function of facts/figures and of their meaningful connections or, I = *f*(n,e), where I = Information, n = nodes (facts/figures) and e = edges (for meaningful connections). The smallest unit of information (IU), according to Hoffmann, is a unit consisting of two nodes (facts/figures) and one connection between the nodes. The more facts (nodes) and edges, the higher the information value and the more edges to one node, the more important the fact or figure. By analysing the number of edges to a node, a "specific weight" or "intrinsic value" of the IU can be attributed. Hoffmann calls this the connectivity (C) of the IU (Hoffmann, 1982: 134).

Burke and Horton (1988: 21) propose the Information Resource Entity (IRE) to solve the problem. An IRE can be anything having the capacity to create, acquire, provide, process or disseminate information. An IRE takes into account both content and medium, for instance, a management report would be purely content, whereas a blank piece of paper would be pure medium. By identifying the IRE's of a business, an inventory of its information resources can be established. This concept will be revisited when information management in practice is explored.

Measurement of resources in general does not present a problem. Human resources, financial resources and natural resources are easily measured in terms of the number of staff, the balance of the bank account or the tonnage of steel. Information, because of its peculiar nature, is not easily measured. This presents a problem and a challenge to the information manager as one would normally first of all determine the quantity of the resource you are trying to manage.

2.13 Information Quality

Information is of vital importance to humans, businesses and nations alike. The underlying assumption, of course, is that such information must be of good quality to be of value. This is a basic assumption for any resource to be valuable. However, the nature of information makes it far more difficult to define what is meant by quality than in the case of, for instance, a natural resource.

Marchand (1990: 9) argues that there are five approaches to measuring information quality: Transcendent-based, user-based, product-based, production-based and value-based.

Transcendent-based means that information quality is universally recognisable, absolute, timeless, enduring and therefore such that it rises above changing tastes and styles. This is clearly an idealistic viewpoint, subjective and not

practical. User-based is based upon individual wants, needs and cognitive styles and therefore just as impractical as a universal measurement. The product-based approach tries to be more precise as it attempts to define the information quality in terms of the characteristics of the information product. The problem, as Marchand points out, is that it seldom happens that there is a one-to-one relationship between quality and the attributes of the information product.

The production-based approach addresses the quality issue from the side of the meeting of requirements. Quality is therefore related directly to meeting of requirements and with "...doing the job right the first time within budget, and on time", resulting, generally speaking, in lower costs (Marchand, 1990: 9). The problem with this approach, as Marchand points out, is that user requirements change over time and this approach therefore does not provide a satisfactory answer over the longer term.

The value-based approach looks at the value obtained from the use of information measured against the ease-of-use, time saved, cost saved, the reduction or elimination of unwanted information ("noise") and, lastly, the quality of the information. It balances the elements of excellence and worth and results in "affordable excellence" - a concept which does not have well defined limits and is often subjective.

Marchand proposes eight dimensions of information quality:

- The actual value an information product or service has for the user. This is, of course, a very subjective judgement which may vary widely between users.

- The features associated with the product or service. Included would be the accuracy or comprehensiveness of the information.

- The reliability of the product or service. Inaccurate information from a

reliable source may be worth more than accurate information from an unreliable source.

- Meaning over time. Even though the meaning of information varies over time (and also between different users), the meaning is still an important dimension of quality.

- Relevance. This is to be differentiated from meaning over time. Relevance refers to the degree to which the information conforms to the users' specifications or standards.

- Validity. This dimension refers to the method or techniques employed to arrive at the information.

- Aesthetics. This is a subjective dimension associated with the way in which the information is presented.

- Perceived value. This is another subjective dimension and refers to the reputation of a product or service as an indirect way to measure different information services or products. (Marchand, 1990: 10 - 12.)

Schwuchow (1990: 56), with reference to information services, lists a number of "indicators" of the quality: Reliability, up-to-dateness, novelty, speed/frequency, completeness, selectivity, relevance, integrity, security, user-friendliness, flexibility and accessibility. Olaisen (1990: 96) suggests two interdependent groups of quality "factors", namely the cognitive authority group (*how* the information is perceived: Credibility, influence, reliability, relevance, meaning over time, validity and perceived value) and the technical user-friendliness factors (*what* the user is offered: Form, novelty, accessibility, timeliness, desired speed, flexibility, completeness, intrinsic plausibility, selectivity browsing and features).

It is clear from the above that these dimensions, factors and indicators are all

very subjective. This should not come as a surprise as information itself is subjective: Data put into context and perspective. Schwuchow (1990: 56) draws the conclusion that "...it is impossible to find a simple overall measurement for the quality of information services". Although he says that about services, the same may be said for information itself. Rice and Blair (in Schwuckow, 1990: 54) say: "...quality [of information] may be largely subjective and determined separately by the producer and the user".

Hegedüs (1990: 73) has another suggestion. He links the quality of information to its usage and concludes that the "....level of usage must be an important factor in evaluating the quality of information". If information is being used, it would indicate a certain minimum quality level or the usage would not occur. This is, of course, a dangerous assumption as a person may be forced to use the information he does have at his disposal with disastrous results. The fact that the information was used, does not necessarily mean that the quality was good.

Marchand (1990: 14) suggests that the relationship between quality and cost, price, market share, productivity and profitability should be investigated. The relationship between quality and cost seems to be inversely related: The higher quality leads to higher costs (although one could think of higher costs without, necessarily, higher quality). However, higher quality information could lead to a reduction in overall cost, leading to higher profitability, possibly through increased market share.

These relationships may appear to be apparent on the surface, but would be extremely difficult to prove scientifically. Too many factors influence price, market share, profitability and productivity to empirically prove direct relationships.

Intuitively, one feels that the higher the quality of information, the higher the payoff as a result of applying the information. Ideally, high quality information should lead to higher quality decisions (resulting in lower overall costs,

higher profitability and market share) in an organisational setting and to increased knowledge on a personal level. However, this is assuming that decision makers always take rational decisions and that people recognise quality information when they come across it. This is, however, not always the case. As Olaisen (1990: 97) puts it: "...information seeking behaviour is neither logical nor rational. The importance of satisfying information need is dependent on the situational context and different situational contexts will involve different quality factors."

The only fact one can state with any degree of certainty is that information of poor quality will undoubtedly lead to poor results, in whatever form the results are measured. Nevertheless, quality information must be seen as important, however difficult it may be to define or measure it. Casanova (1990: 51) writes: "Total quality in information is the search for 'Eldorado'".

The challenge is to seek or to provide quality information for the particular situation, taking into consideration the cost to obtain or provide the information.

2.14 Summary and Conclusions

The concepts data, information, knowledge and wisdom are closely related. They are also common terminology to both laymen and experts. It is therefore not surprising to find that these terms are very difficult to define in such a way that all the different meanings attributed to them are catered for.

There are few disagreements as far as the term "data" goes. Most definitions agree that data are facts not having any meaning on their own. Because a fact needs to be a truth, a move away from the word "fact" is suggested. Data are therefore defined as attributes with no apparent meaning.

Definitions of information differ widely, but all agree on the fact that meaning plays an important role when it gets to information. The moment data are put

into context or perspective is added, it becomes information. Information is therefore defined as data put into context and perspective. This brings a very important aspect to the fore, namely, that information always has context and perspective attached to it. This explains why the "same" information does not have to carry the same message to everyone. The contexts and perspectives added by the recipients may be different and hence the difference. One can never talk of information without also talking about context and perspective. De Bono (1992: 29) says: "...information comes wrapped in concepts and perceptions".

Having added context and perception to data and in the process having created information, the recipient adds it to his existing body of beliefs. It then becomes "knowledge" to him. Knowledge exists in the minds of people and is therefore intangible. It is personal - what the person believes in - but a common set of beliefs, justified over years through experience and reason, becomes knowledge to a group of people (a business, for instance), perhaps the entire world population. Such knowledge still depends on context and perception but because all these contexts and perceptions have evolved to be the same, they do not matter that much any longer.

Wisdom is gained from the use of information and knowledge and is strongly situation dependent, hence someone can be called "wise" in a given situation and completely ignorant in another. Wisdom depends on the "connections" a person makes in respect to the information and knowledge available to him. Such "connections" lead the person to show remarkable insight into a situation and to make sound judgements.

Common use of the above terminology does not distinguish between the different terms. In order to overcome this problem, one could generically call the collection of data, information and knowledge information and then differentiate between information-as-thing, information-as-knowledge and information-as-process. Data and information would then qualify for information-as-thing (tangible, a "resource") and knowledge would be informa-

tion-as-knowledge (intangible). Transformation from tangible to intangible is possible through contextualising or perceiving, whereas from intangible to tangible would be through expression. Tangible to (other) tangible and intangible to (other) intangible transformations are also possible. Information-as-process refers to the process of transformation, or being informed. This leads to the notion of two dimensions of information: As resource (information-as-thing) and as process (information-as-process).

The moment man was created, information began playing a role in his life. In fact, the moment after creation, he was given information by God. The process of being informed has not ceased and will never cease. People want to be informed and want to inform others. It did not take man long before he devised a way to record information more permanently than just passing on the word from one generation to the next; substantiated by the egyptian hieroglyphics already perfected in the days of the first dynasty (3110 - 2884 BC). The recording of information has today reached unparalleled levels both in terms of volumes and in sophistication. The downside of it is that it rapidly reached such proportions that it is impossible to keep abreast of everything being recorded. This provided fertile ground for the proliferation of information technology to help humans cope with the data glut.

Information-as-thing has some peculiar characteristics which distinguishes it from other resources such as financial, human, equipment and material resources. It can be expanded by adding more information to it, but can also be compressed through summarising. Information can be shared by many without anyone losing "his" information. It could even be sold, without getting depleted and it could have more than one owner at the same time. It can be transported (transmitted) at the speed of light. The same information could have different effects on different people. Some may be thrilled by it while others may be left cold by the same information. One moment a person may be willing to pay an enormous amount for information, a minute later the same information may be completely and utterly worthless. Determining the cost and the value of information is not easy, especially under the above circum-

stances.

Unlike other resources, there is no handy unit of measure for information. It has been suggested that bits, characters, words and so on must be used and, through lack of something better, it is being used all the time. The problem remains: How is the meaning being measured, bearing in mind that it is usually the meaning which is the important part. Various methods have been proposed without much success.

Determining the quality of information is just as difficult. Because of the subjectivity (contexts and perceptions) which is part and parcel of information, quality has different meanings to different people. This presents a specific challenge to the manager responsible for information as, generally speaking, the higher the quality of the information, the better the decision taken. Normally though, the higher the quality, the higher the cost.

These characteristics call for a specific approach when information is being managed and when being treated as an economic good. It cannot be treated just like any resource. It is a special resource and it would be a mistake to treat it just like the other resources. It is a powerful resource; major changes can be brought about through its use thereby affecting the lives of millions. Through its use other resources can be conserved. It must be used with care and the necessary responsibility.

Now that the nature of information has been explored and information and its related concepts have been defined, a broader framework for information is needed. Does it have a broader purpose in real, everyday life? Where does it manifest itself? These, and other aspects, will be investigated in chapter 3.