INFORMATION USE VALUE:
A TEST ON THE PERCEPTION
OF UTILITY AND VALIDITY

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Abstract — This research focuses on the use of scientific information disseminated in primary subject literature. Use is analysed under the specific topic of obsolescence. Object-Content-Use syndrome was the starting point for the conceptual distinction between Content (information) and Object (document) obsolescence. It is argued that quantitative measures of obsolescence are based merely on Object parameters, and thus cannot be used to infer Content validity and utility. Accordingly, it is hypothesized that Object obsolescence is disjoint of Content Obsolescence. The main objective of the study was to develop a methodology for hypothesis testing. The method implies measurement of Object obsolescence by means of citation analysis, measurement of Content obsolescence by means of expert opinions, and comparison of the results. The hypothesis was tested in an exploratory way in the field of Bibliometrics. Main results of the study are that the hypothesis was confirmed at the perceptual and inferential levels. It is shown that information validity and information utility are not related to document age.

1. INTRODUCTION

The published literature — one of the most tangible products of scientific endeavour — is formed by documents that can be talked about in terms of *Object, Content*, and *Use*. Object refers to the documents' physical support (paper, magnetic tape, etc.); *Content* to its message, its aboutness; and *Use* to its real or potential usage. They form the so-called O-C-U syndrome (Rawski, 1977). This distinction is basic for defining the problem that can be stated as follows: The Information (C) is codified in a document (O) which conveys that same information for a potential use (U). This use in its turn can be studied through the analyses of the obsolescence phenomenon (see Fig. 1).

A research was undertaken to focus on this property of the *Use* attribute: the phenomenon of Obsolescence.

One may say that obsolescence studies focus on the relations between document usage and the passage of time, and seek to identify changes in use patterns. Zunde and Gehl (1969, p. 69) state that information decay is a central topic in Information Science and that "little is known about the different processes and the associated laws according to which different kinds of information lose their meaning, validity, relevance or value. Work done so far has described only the aging of documents."

The decline in time of literature usage is causally associated to loss of information value. In other words, it is supposed that the number of citations given to a document — whose age is characterized by its publication date — is a quantity describing information or document utility.

Obsolescence-related research has produced many mathematical formulas, but unfortunately they have been neither simple nor universally applicable. "The best researchers are the ones who have admitted that obsolescence is a far more complicated and hypothetical concept than we have hoped" (Gapen & Milner, 1974, p. 107). Although the literature on obsolescence is vast, there is no consensus about changing patterns in document use, adequate measurement, and mainly about the object of analysis. This last question is central to our discussion: What is being analysed? What means obsolescence? What is being considered as the unit of analysis: the Object, the Content, or both?

KNOWLEDGE

INFORMATION

O

LITERATURE --▶   DOCUMENT --▶   C
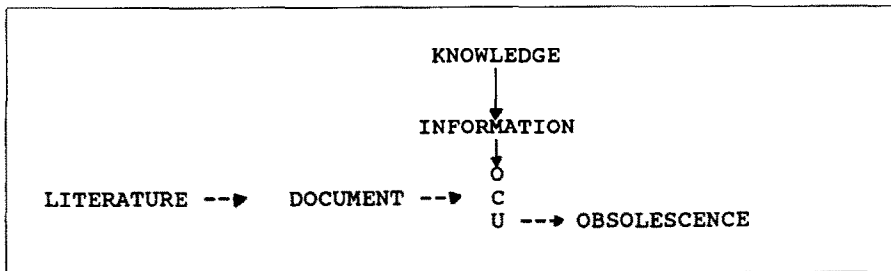
U --▶ OBSOLESCENCE

Fig. 1. Problem definition.

2. THE PROBLEM APPROACH IN THE LITERATURE

In order to answer those questions, a qualitative analysis is needed to get the semantic aspects missing in quantitative studies. This will allow a better understanding of the nature of the phenomenon.

Obsolescence research is centered upon two schools or tendencies: The Anglo/American, which can be seen as whole, and the Soviet school.

The Anglo/American school emphasizes mathematical modelling rather than discussion of qualitative aspects. Line and Sandison's article (1975, p. 283) is an exception, as it makes a distinction between knowledge obsolescence and literature obsolescence: " . . . when speaking of the obsolescence of information it is important to be clear whether the concern is with documents or with the information they contain, representing knowledge. If documents are being considered, the interest is usually a practical one . . . if the concern is with knowledge, obsolescence may be defined as a decline over time in the validity or utility of information."

The distinction between knowledge and document obsolescences was disputed by Brookes (1975, p. 47), who nevertheless stated that "studies of obsolescence [document] and of "obsolescence" [knowledge]* have very different objectives, require very different methodologies and are based on very different measures and very different epistemologies."

Brookes (1981, p. 3), when conceptually reviewing his negative exponential law, also applied to obsolescence ($C(t) = Ke - at$), argues: "What I thought I was measuring was the rate of revision of scientific knowledge . . . [and that] the aging coefficient a was a measure of this rate . . . i.e., I was exploring what I now call the changing structure of world III" [objective knowledge].* Although emphasizing quantitative analysis, Brookes takes a cognitive view of the problem and points out conceptual differences in the object of study. As in Line and Sandison's article, we can find a perceptual difference between knowledge-information-document.

The Soviet school emphasizes qualitative analysis and accordingly, it explicitly perceives differences between obsolescence of the object and of the content. Polushkin (1977, p. 13) states that "the concept of document combines the medium [object] and the information [content] recorded on it.* The aging of each of these two components is of a different nature . . . At the present there are no compelling reasons to consider the aging of the medium and the aging of information simultaneously."

According to Mikhailov (1981, p. 81), "the obsolescence of literature refers to the fact that as they "age," publications tend to lose in utility as sources of scientific information and tend therefore, to be used less and less . . . It is not scientific information which becomes obsolete but the associated publications as new publications appear that contain a new, fuller or more accurate scientific information."

Motylev (1981, p. 4) thus expressed his ideas: "Scientific communication is attended by obsolescence of information and the obsolescence of the scientific and technical literature . . . Information obsolescence refers to the fact that theories and hypothesis come

*Brackets added.

to be refuted . . . The obsolescence of the literature is quite another matter. Because publications are not limited to original information, but will include borrowed information as well, and because any information is apt to be duplicated many times over in the literature, most books and papers will lose their utility even though their information may not become obsolete."

The verbal expression of these two schools of thought are lexically different, but have similar semantical approaches to the phenomenon which can be synthesized as follows: (a) obsolescence of both Object and Content have the same denotation; the connotations are distinct although often imprecise; (b) both obsolescences are sometimes seen as depending upon a revision of scientific knowledge; (c) utility and validity are notions frequently associated, in the literature, to interpretations of quantitative analysis. When analysing information usage, one naturally assumes that information was used because of its validity and/or its utility.

The concept of Content obsolescence is brushed upon in the literature; it also needs to be discussed more.

2.1 *The concept of Content obsolescence*

As applied to material objects, the concept of aging is easily understood, but when applied to information, it is quite complex. In order to illustrate the discussion, the diagram in Fig. 2, which is a slight modification of Fig. 1, based on Polushkin, will be used.

Roughly we may state that knowledge embodies the study of phenomena of the natural or social world that have specific properties. Documentary information is the informational content of a document that reflects the knowledge object and represents its distinctive traits in a given point in time.

As already stated, the information aging process is associated to a gradual loss of value as time goes by. The older the information, the smaller its value. Further examination of this process shows that there is a supposed but not tested association between information aging and the loss of information value. This assumption changes qualitatively the concept of aging.

When considering information obsolescence, we have to question whether the loss of information utility and validity is linked only to aging issues. This remark was made earlier by Burton and Kleber (1960, p. 19) when they made an analogy between the half-life of a radioactive substance and the rate of literature aging. These authors explicitly said that "unlike a radioactive substance which becomes an entirely different substance as it degenerates, the literature simply stops being used: it ages but does not lose its usability."

Every time we associate information obsolescence to its pragmatic utility, we are implying the I-U (information-use) relationship and by doing so, omitting the K-I (knowledge-information) relationship. That is to say, we are not taking into account properties of the information aging process, which are in turn related to the knowledge they refer in different points of time. We intuitively understand that the decline in users' interest is associated not only to a time reduction of literature utility, but also to qualitative parameters that can be found in the knowledge-information (K-I) relationship.

Scientific knowledge is always changing, but information codified in a document cannot change, because it has an invariability property as it reflects, at a given point in time, the knowledge it covers.

A photograph is a good example of this: the image in it corresponds exactly to the
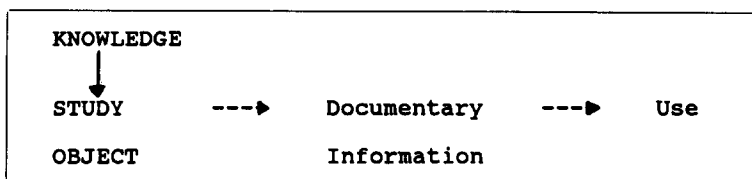

Fig. 2. Content obsolescence.

real thing *only at that point in time* when the photo was taken. With the passage of time the difference between the photo's image and the photographed object becomes gradually greater. This dynamic is the key to understanding the information obsolescence phenomenon.

The information contained in a document does not change; what changes is its validity as compared to more recently published contents, which may be transmitting a new knowledge state (i.e., when older information is replaced by new information). Some properties of information such as *truth, validity*, and *accuracy* are defined by K-I relations; more pragmatic properties, such as *utility* and *usability*, are defined by I-U relations.

One might state that Content obsolescence is the gradual increase in the discrepancy between knowledge and its reflexes at different points in time. But this is a quite complex process. We may say that the concept of Content obsolescence is *n*-dimensional and evolves from the knowledge information and from the information use relations.

3. HYPOTHESIS

When analysing information obsolescence properties — validity and utility — the usual practice is to study Object parameters and to extend the results to the Content therein codified. Nevertheless, the nature of document usage and information validity remains unknown, mainly because there are no adequate quantitative techniques to analyse the problem. "It is not possible to know by the decay in document usage which kind of obsolescence occurs, as changes in document use are not necessarily similar to changes in information validity and utility" (Line & Sandison, 1974, p. 284). The decay in document usage intensity can occur even if its content is valid and potentially useful. We cannot infer information validity and utility by quantitative analysis.

Utility and validity are indirectly observable characteristics of information use and therefore not directly measurable. The Object can be studied as a discrete variable — subject to objective measurement. Measurement of Content obsolescence is complex; it is a continuous variable which can only be measured through subjective techniques. Consequently, the sole utilization of quantitative indicators as described in the literature is questionable, as leading to infer information utility and validity. Any set of techniques used to extend to Content, measurements related to Object — and vice versa — is inadequate, for content and Object are distinct entities. This argument allows for the formulation of the following hypothesis: Content (information) obsolescence is disjointed of Object (document) obsolescence.

Accordingly, this study's main objective is to develop a method for hypothesis testing; secondary objectives are: to identify variables for measuring information obsolescence; and to apply the developed methodology, in an exploratory way, to an area of knowledge.

4. MATERIAL AND METHOD

The method was tested in the area of Bibliometrics and encompassed three distinct and successive stages: (1) determination of Object obsolescence through citation analysis; (2) determination of Content obsolescence by expert evaluation; and (3) comparison and analysis of results.

In the first stage, the method comprised the creation of two data bases, the first one composed of an accidental sampling (Bailey, 1978) of 45 papers published between 1986 and 1987. These papers were extracted from the subject heading "Bibliometrics" in the 1988 and 1987 volumes of LISA — Library and Information Science Literature. This database was called *Source Literature* (SL). Two files were then formed: file 1, with the first and last pages of each paper sampled, and file 2, with bibliographical data extracted from LISA. These were analysed according to the following items: first author's name and institution; location (country of first author's institution); article title, journal title, publication date; language and LISA's subject headings.

The second database, called Cited Literature (CL), was generated by registering all references cited in the papers of the SL database.These were analysed according to the following items: type of cited document, document identification, and publication date.

Out of the 45 papers in the SL database, 36% were indexed under the subheading "citation analysis," 17% under "author productivity," and 13% under "bibliometrics' analysis by subject areas." These papers cited a total of 781 documents, out of which 465 (60%) refer to the journal literature; these references form the CL database.

The size of the CL database conforms to Brookes (1970), who advocates a sample size from at least 400 references to get a .90 confidence level for the estimated half-life. The obsolescence rate may be measured by a plotted curve, by graphical techniques, or otherwise, by some numerical measurement. In synchronous studies like this one, the obsolescence rate may be the half-life—that period of time needed to account for one half of all the citations received by a group of documents.

The time range of the cited articles lies between zero and 106 years. Data showed that the median half-life for the Bibliometrics literature is ca. nine years. This "nine years" was established as an observation period.

In the method's second state—determination of Content obsolescence—two instruments were used to collect data: a set of cited articles (SCA) and a self-administered questionnaire.

SCA was composed by a probabilistic sample of 30 papers selected from the CL database; these papers were distributed in four decreasing observation periods in relation to the publication date. In order to get valid comparisons between the obsolescence of Object and of Content, the dates of the SCA papers were related to observation periods— each corresponding to the median half-life of nine years, as stated before. This procedure reflects the dynamics of Object obsolescence: As the document ages, there is a decay in its citation frequency.

Accordingly, in the first period there is a set of more recently published papers, whose contents are probably not obsolete; papers in the subsequent periods are older and their contents may be obsolete or not. Table 1 shows the distribution of SCA papers by observation periods.

The questionnaire involved semantic analyses of the terms to be included. As the central theme of this research is focused on the loss of information value along time, the following questions for hypothesis testing were in order: What distinguishes an obsolete information from a not obsolete one—time (age), validity, or utility? What are the properties of a "useful information?"

The selection of terms to be employed in the questionnaire was guided by these questions and also by literary warrant. In the first stage, the terms denoting information value were semantically decomposed into two constructs: validity and utility. Terms whose meanings characterize those properties were then identified; at the same time, terms for expressing information quality were chosen. For the selected terms, their meanings and interrelations— synonymy, antonymy, and subordination—were established in the light of temporality dimensions (i.e., time and value relationships).

The terms selected were then grouped into three categories: terms for the judgment of Content obsolescence, which reflect the K-I relationships and have temporality connotation; terms for the judgment of information usability, which reflect I-U relationships and have subjective value denotation; and terms that have positive or negative information value denotation and reflect properties of terms in the first and second groups.

For judging Content obsolescence, the main terms— *Updated* and *Outdated*—have distinct temporality meanings. *"Updated"* was supposed to connote, in a synchronous way,

Table 1. SCA: Number of articles by observation period

Period	Dates	Limits	Number of Articles
P1	1986	78	8
P2	1977	69	7
P3	1968	60	8
P4	1959	51	7

the temporality process, and *"Outdated"* was supposed to do the same in a diachronous way. That is, the association between time and value may occur in an inextricable way as related to past and present times for the "Outdated" variable. Consequently, a greater temporality span perception for this variable was expected.*

For judging information usability, the main terms — *Utility* and *Potential use*—denote use value at some *subjective expected* level (Repo, 1986). It should be emphasized that these terms were used in a rather narrow way — it was intended to distinguish and differentiate the utilitarian value of information in the aging context, according to the following statement: A recently published information may be useful and/or usable or not; the same applies to older information. There are exceptions, of course, as found in Knowledge divulgence/popularization when information usability is taken for granted — this usability is also due to the historical value — although historical value is distinct from scientific value. Lastly, information utility is dependent upon the way it is evaluated by the hypothetical user in a concrete situation which creates motivations for immediate or potential use.

The questionnaire's first version was tested by three graduate students and three professors of the Master's Course in Information Science, Federal University of Rio de Janeiro/Brazilian Institute for Scientific and Technological Information. The last version is described in the next paragraphs. It consists of two blocks; in the first, there are two kinds of questions: in the first kind, a four-point scale was used to express Content obsolescence and usability judgment. Numerical grading was expressed in a descending way (in the scale, the greatest value is 1), excepted for the "updated" variable, expressed in ascendant values (in the scale, the smallest value is 1). In the second block, the term *"Backward"*—synonymous with Outdated — was used in an associative question to identify the respondents' perception of information temporality.

Data were structured as follows: All data were statistically described; the Content obsolescence and usability variables were correlated; the same statistical analysis was applied to the hypothesized relations between these variables, and the *date* variable was related to the Object. The following correlations (*r*), positives (+) or negatives (−), were statistically expected for the judgment between pairs of variables:

r, date, updt.	(+)	*r*, updt., out	(−)
r, date, out.	(−)	*r*, updt., util.	(−)
r, date, util.	(−)	*r*, updt., p.use	(−)
r, date, p. use	(−)	*r*, out., util.	(+)
		r, out., p.use	(+)
		r, util., p.use	(+)

To interpret: The more recent the document, the more "uptdt." (updated) the information it contains that will also be less "outdt." (outdated), of more "util." (utility), and more "p. use" (potential use). Accordingly, the more recent the Object, the larger should be the "updated" indices and the smaller should be the other variables' indices. The same reasoning can be applied to the other correlations.

A selective sample of ten Brazilian researchers was the respondent population, all of them experts in Bibliometrics and engaged in teaching and/or research; six of them hold a Ph.D. degree and four a Master's degree.

The questionnaire administration followed the procedure described next: (a) each respondent received three different SCA papers whose main identification features were obliterated — author (s) with respective affiliation, journal title, data of publication; (b) to each paper was attached a questionnaire to be filled up after examination of the paper; (C) two interviews — pre and post questionnaire completion — were added to the procedures. Thirty questionnaires were sent attached to thirty different papers, to ten different experts. Twenty-seven (90%) were returned (i.e., one expert did not answer the questionnaire nor read the papers).

The first interview aimed at obtaining the expert's cooperation. The second one aimed

*The original Portuguese expression for each term is *atual* (updated), *ultrapassada* (outdated), *utilidade imediata* (utility), and *potencial de uso* (potential use).

at correcting occasional misunderstandings. This second interview highlighted some interesting aspects related to the psychology of the respondent's perceptions—two negative reactions to the obliteration process as a whole for instance: "The erasure of the dates didn't allow me to follow the author's reasoning"; "obliterated parts are integral components of the text, and their omission, damaging to the judgment." About one third of the papers were already known by the respondents, who nevertheless declared having filled up the questionnaire without bias. Five papers were not acknowledged as belonging to the field of bibliometrics or to their area of interest. Anyway, this is an old problem; in a pre-paradigmatic discipline like Information Science, even in a sub-field like Bibliometrics with theoretical boundaries more or less defined, there are problems related to the area's delimitation.

5. RESULTS

Results are presented in three parts: the first and the second correspond, respectively, to the first and second block of the questionnaire; the synthesis and analyses comprise the third block.

5.1 *Perception of the concept "Information Temporality"*

Before the analysis of the respondents' perception, a brief comment on the notion of paradigm is needed. Kuhn used the term paradigm to describe the body of theories accepted by the members of a specialty community. According to Böhme (1977), in Kuhn's perspective, the validity of a theory is a sociological phenomenon; in decisive eras of scientific development, the transition of one paradigm to another has, as corollary, the internal realignment of the scientific community or the flourishing of new ones. "What changes in the transition to maturity is not the existence of a paradigm, but the paradigm's nature" (Kuhn, 1970, p. 79). It is important to note that this change can be a decisive factor in the perception of information temporality. Thus, one can equate the paradigm concept to the terms employed in the questionnaire and by the respondents, to guide the perception of obsolescence of Content: "state-of-the-art" and "theoretical/conceptual frame of reference."

The results of the analysis of the respondents' perception indicate that the meaning of *backward* and *not backward* as established in the questionnaire were accepted with all their methodological implications.

Another analysis showed the respondents' definitions to be redundant—semantically they did not add to the terms used in the questionnaire. In short, the temporality concept was perceived by the respondents according to the associations in Table 2.

As an interpretation, we may say that *backward* information is not updated (governing paradigm dimension), not relevant, and useless (use-value dimension), with exception made to historical value. These results are consistent with the respondents' definitions, and indicate mainly that Content obsolescence is determined by several factors that are strongly interwoven in a valuation chain that occurs at three main dimensions: time, governing paradigm, and relevance.

The respondents' perception of the phenomenon of Content obsolescence is thus expressed and analysed: (1) the time dimension (T) is fundamental to the judgment of *validity*, which is associated to changes in the governing paradigm. As these changes occur

Table 2. Information temporality perception

1. Backward	(2) updated
	(-) recent
	(1) not updated
	(-) old
2. Not backward	(2) useful
	(1) not relevant
	(1) useless
	(2) relevant

Table 3. Content judgment map: Numerical indices by observation periods

Observation period	UPDT.(+)	UTIL.(−)	UTIL.(−)	P.USE(−)
P1				
85	4	1	1	1
85	2	2	3	2
84	4	1	2	2
82	4	1	2	1
82	3	1	1	1
79	3	1	3	3
78	1	3	3	2
P2				
74	2	3	3	3
74	3	2	2	2
73	4	1	1	1
73	4	1	1	1
72	3	1	1	1
71	2	3	3	3
70	2	2	3	3
P3				
68	2	3	3	3
67	3	2	2	1
67	3	3	2	2
66	2	2	3	2
64	2	3	3	3
64	3	2	2	1
63	2	2	3	2
P4				
58	1	4	3	3
56	3	2	3	3
56	4	1	1	1
55	4	1	1	1
55	3	2	2	1
52	3	2	2	1

intermittently, the information validity will have, accordingly, a shorter or a longer duration; therefore validity has a time/value (T/V) dimension; (2) the information use value is induced by its quality, which depends upon a "paradigmatic validity." The results point out that information utility is expressed across the relevance concept. Therefore, *relevance* is the qualitative perception of the knowledge communication process via information — this is not a surprising result and is in accordance with the concept of relevance (Saracevic, 1970).

5.2 *Content obsolescence*

Table 3 indicates to each parameter, the judgment indices for the 27 papers received; these indices are ordered in decreasing sequence of the Object's obsolescence — P1, P2, P3, P4. There is an almost total absence of extreme negative judgment.

Table 4 shows for each judged parameter and by observation period, the means (x), the general means (G), as well as the corresponding standard deviations (s).

The behavior of these variables,* individually, can be summarized as follows: (a) the majority of the contents is more updated (63%), less outdated (75%), more useful (56%), and of more potential use (70%); (b) at all observation periods, there is a concentration of papers judged more updated, less outdated, more useful and with more potential use; (c) judgments are consistent with the defined concepts.

In the next stage, a bivariate analysis was made in order to verify the interconsistency of the judgment indices. The main results* are (a) *Updated* and *Outdated* variables may be measuring different dimensions of information temporality; (b) associations of *Outdated* and *Utility* variables are partially consistent; (c) at the general level, the results are interconsistent and compel to hypothesis acceptance.

*Because of space limitations, tables related to this analysis are not presented.

Table 4. Content judgment indices: Means and standard deviations

Observation Period	UPDT.		OUDT.		UTIL.		P.USE	
	x	s	x	s	x	s	x	s
P1	3.0	1.2	1.4	0.8	2.1	0.9	1.7	0.8
P2	2.8	0.8	1.8	0.9	2.1	0.9	2.0	1.0
P3	2.4	0.5	2.4	0.5	2.6	0.5	2.0	0.8
P4	3.0	1.1	2.0	1.1	2.0	0.9	1.7	1.0
G	2.8	0.9	1.9	0.8	2.2	0.8	1.8	0.9

As for inferential statistics, Table 5 shows the general (G) and the partial (P) (i.e., observations periods) correlation indices between the *date* (Object's variable) and the Content variables: "updt." (updated); "outdt" (outdated); "util." (utility); and "p. use" (potential use).

The general indices (G) show that *there is no correlation* between date and Content variables: r tends to zero, with an exception to the "date, outdt." correlation, which displays a weak and not statistically significant correlation. Also, by observation periods, the indices are not statistically significant. Depending upon sample size used as calculation base, r is significative ($p = 0.05$) in the following levels: G ($n = 27$): $r \geq 0.388$; P1, P2, P3 ($n = 7$): $r \geq 0.754$; P4 ($n = 6$): $r \geq 0.878$.

The correlations between the content's pairs of variables are in Table 6, where the general (G) and partial indices are given by observation periods (P). All the general correlations (G) are statistically significant and display the supposed relations. There is a strong correlation ($r = -0.83$) between "updt." and "outdt.," and between "updt." and "util.", indicating the more updated the information, the more useful and the less outdated it is; between the others pairs of variables, the correlations' values are intermediary, except for the "util." and "p. use" variables, which are strongly correlated ($r = 0.83$). It would be logical to expect the same intensity of correlation between "p. use" or "util." and the other variables, but this does not happen. This discrepancy does suggest that other variables not associated to information temporality might interfere with the information use phenomenon.

By observation periods (P), all partial correlations reflect the supposed relationships at different statistically significant levels; the correlation indices distributions (rows) are random and also show that these relationships do not follow the ordering of the obsolescence of Object.

As the preceding analysis has indicated a distinction between the *updated* and *outdated* variables, this distinction can now be probabilistically examined. The correlations are strong and statistically significant in all the observations periods; the exception is P3 ($r = -0.17$), with a low correlation. This shows that only in that group the judgments do not express the expected relations, and explains the distinction previously found.

At all points of analysis, judgments of the P3 papers — published between 1963 and 1968 and listed in Appendix A — were an exception or had their indices undefined; among

Table 5. Correlations of parameters relating to the judgment of Content and Object's date

Variables	G	P1	P2	P3	P4
(+) r, date, updt.	0.09	0.52	0.42	0.21	−0.46
(−) r, date, outd.	−0.28	−0.41	−0.07	0.37	0.46
(−) r, date, util.	−0.04	−0.59	−0.42	−0.21	0.34
(−−) r, date, p.use.	0.01	−0.51	−0.33	0.11	0.66

Table 6. Correlations of Content's pairs of variables

Variables	G	P1	P2	P3	P4
(−) r, updt., outdt.	−0.83	−0.92	−0.85	−0.17	−1.00
(−) r, updt., util.	−0.83	−0.64	−1.00	−1.00	−0.82
(−) r, updt., p. use.	−0.66	−0.38	−0.93	−0.50	−0.71
(+) r, outd., util.	0.68	−0.61	0.85	0.17	0.82
(+) r, outd., p. use.	0.65	0.24	0.93	0.76	0.71
(+) r, util., p.use.	0.83	0.86	0.93	0.76	0.87

the eight papers in this group, four are "classics" on Bibliometrics (Brookes, Kessler, Leim-kuhler, and Price); two are about productivity applied to the sociology of knowledge (Dennis and Pelz), and one is about journal selection (Karel). It is probable that these papers, by their very nature, have influenced the judgments made; the respondents, due to their teaching activities, must have emphasized the historical value of these papers. Therefore the judgement of papers in the P3 set are biased and cannot be further considered.

In synthesis, the analysis of correlations showed that: (a) variables related to the obsolescence of Content have the supposed relationships, *with exception* to the P3 set; (b) other variables not associated with information temporality may interfere with the information use phenomenon; (c) ordering of Content obsolescence does not occur via Object obsolescence; (d) there is no correlation between Object obsolescence (date) and Content obsolescence. These results further corroborate the hypothesis.

5.3 *Obsolescence of Object × Obsolescence of Content*

Theoretically, and in the respondents' perception, the obsolescence of Content is determined by several interwoven factors that interact in three main planes: time, governing paradigm, and relevance. The governing paradigm plane is central to these valuations; according to the conceptualization made, it is a K-I relationship expression; the relevance plane belongs to the I-U relationships. Figure 3 is a simplified and tentative diagram to depict the theoretical relationships involved in the information obsolescence process, which shows: the time (T) dimension—where the knowledge (K) is situated; this knowledge expression (i.e., the Information (I), and a paradigm (P)). In parallel, there is use (U) valuation of that information.

At a certain point in time (t1) there is a *governing paradigm* (Pt1), which reflects part of the knowledge accepted as true at that point in time. Independently of the time when it was generated, the information will reflect or not reflect that paradigm; if it does, it is *paradigmatic* (IPt1) and thus valid (V); being valid, it is updated (D), and when evaluated for use purposes may be judged *relevant* (R), and thus for immediate or potential *use* (U).

Some time later, for example, at t2, if the nature of the paradigm is altered (Pt2), that information (IPt1) will not reflect the new paradigm, and for this reason will lose its validity (NV); by not being valid, the information becomes *outdated* (O) or backward and when evaluated for use purposes may be judged *not relevant* (NR), and thus without immediate or potential use (i.e., not useful (NU)).

It was with that perception that the respondents judged the information contained in SCA papers. For interpreting purposes, the results are synthesized in Table 7, where the judgments for each variable—expressed in relative means and referring to the "nine years" observation periods—are decreasingly ordered.

Before interpreting this synthesis, one should note a data limitation: Some means express neutral or undefined judgments (50%). The scale intervals were intentionally limited to avoid a central point. The results indicated that respondents did not use extreme negative values; as the judgments were inter-consistent, there can be a bias due to the interval scale, which probably was not adequate to express the magnitude of the problem. Because of this limitation, some interpretations are really tentative.

For all of the variables (column indices), the ordering sequence is distinct from the ordering of Object obsolescence; the contents in older objects—as in P4—are of as much po-
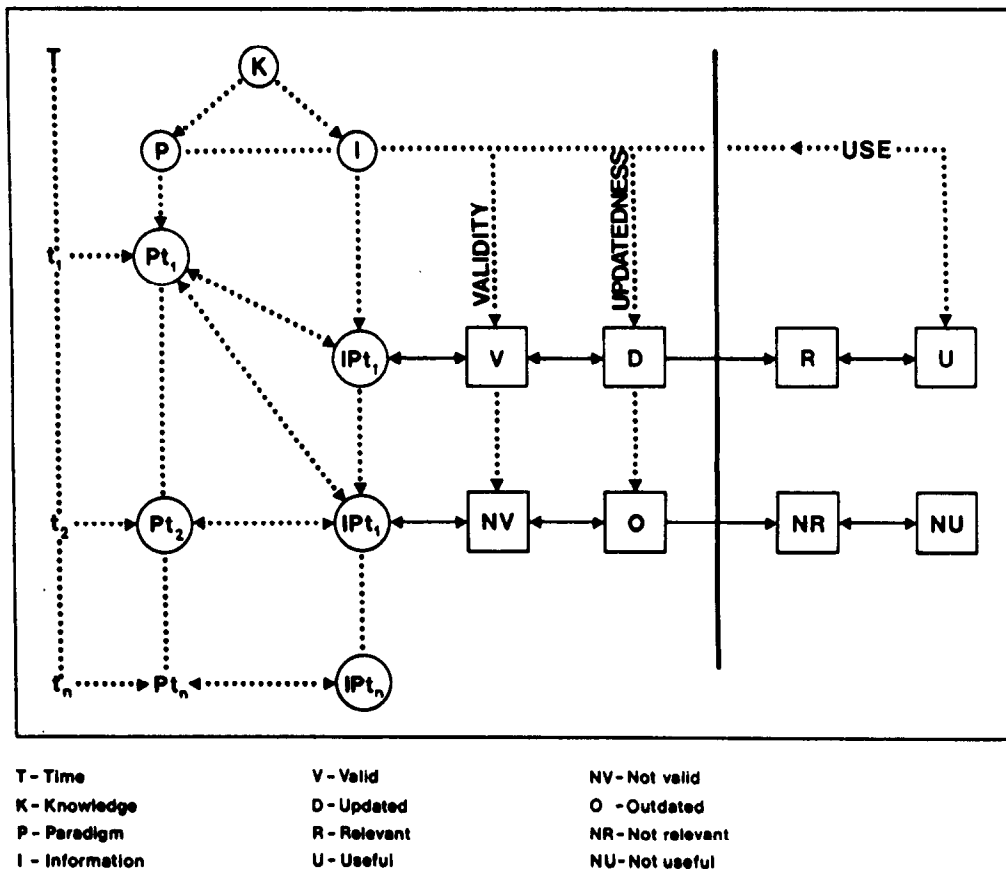
Fig. 3. Information temporality: Theoretic diagram.

T - Time
K - Knowledge
P - Paradigm
I - Information

V - Valid
D - Updated
R - Relevant
U - Useful

NV - Not valid
O - Outdated
NR - Not relevant
NU - Not useful

tential for use and as updated as the contents in more recently published objects — as in P1. It is not possible to discern a coherent pattern in the time ordering of Content by the chronological sequence of the obsolescence of Object.

Comparison of results is better visualized if the indices *above the mean* for "updt." and *below the mean* for the other variables are taken as meaning an updated, not outdated, useful, and potentially useful paper. It can be seen *that all contents are updated;* the majority is not outdated (P4 is at the limit), has no immediate utility (P4 is at the limit), and has a potential for use (P2 is at the limit).

Table 7. Synthesis of Content judgment: Means ranking by observation periods

	Judgments			
Rank	UPDT.	OUTD.	UTIL.	P.USE
1	P1 and P4 (75%)	P1 (35%)	P1 and P2 (53%)	P1 and P4 (43%)
2	—	P2 (45%)	—	—
3	P2 (70%)	P4 (50%)	P4 (50%)	P2 and P3[a] (50%)
4	P3[a] (60%)	P3[a] (60%)	P3[a] (65%)	—

[a]Biased results.

If all judged papers are updated, one would infer that Content obsolescence *is not compatible* with Object obsolescence — for an updated information would not be obsolete (outdated or backward) in the respondents' perception. It was indicated earlier that the variables *"updated"* and *"outdated"* may reflect different dimensions of information temporality; this is also found in the means of judgments: content of more recent objects (P1) have the obsolescence compatible with Object's obsolescence. On the other side, contents in older objects (P4) do not have the obsolescence defined, as they are updated and also outdated.

Discrepancy in the judgments of the variables "outdated" and "updated" may be seen from different points of view: (a) What is the nature of this discrepancy considering that the variables were conceived and also perceived by the respondents as antonyms? In the analysis of the results it becomes evident that the term outdated has a strong negative connotation — as the term obsolete has. It is possible that respondents have semantically rejected the term. The extent and nature of these variables must be further studied. (b) Some judged papers — in the respondents' opinion — do not belong to the field of bibliometrics, and perhaps this is the cause for neutral judgments (see item 4).

Variables related to use evaluation show that most judged papers do not have immediate utility although articles in the periods P1 and P4 are decisively of potential use, and in the two other periods are at the boundaries. These results can be interpreted as follows: Although valid — "updated" — the information may not be wanted or judged useful for personal reading. In this particular case, the respondents did judge articles that they did not intend to use; nevertheless, the information is valid in the K-1 dimension and has potentiality of use.

Although there are limitations imposed upon this synthesis, we may still state that Content obsolescence is not compatible with Object obsolescence. As a matter of fact, these interpretations reinforce the results exhaustively analyzed in the preceding item: The ordering logic of Content obsolescence does not depend upon the chronological ordering of Object obsolescence. The sequence P1, P2, P3, P4 never does show Content value decrease; the pattern is ever random. Content obsolescence is not ordered via Object's date, not even inversely (i.e., Object and Content are not conjoined in their ordering of obsolescence measurement). It can be concluded that content obsolescence has a proper logic, disjoint from Object obsolescence. The results corroborate the hypothesis.

6. CONCLUSIONS

The main conclusions to be drawn from the results can be summarized into three implications: methodological, practical, and theoretical.

Methodologically, this research has a series of limitations; their occurrence was anticipated, due to the difficulties of dealing with a complex and poorly investigated subject. Its most serious limitations are related to the lack of knowledge about underlying mechanisms of the phenomena analysed, and to the lack of specific results due to the global analysis. But the real need was to establish a preliminary general approach to support more specific studies. So, the results should be looked at as exploratory — it is necessary to test the hypothesis in other disciplines. Related to what was said above, the method developed is original; although adequate to the problem, it must be simplified when applied to other areas of study, in order to be more efficient as a research tool. Besides, the terminology used in the questionnaire should be expanded and refined in order to be further applied.

The validity and comprehensiveness of the variables included in this study are related to the problem of semantic expression. The central question — search for understanding the phenomenon of information use — was analysed as a whole, so that the difference between the variables' *"immediate utility"* and *"potential of use"* was not sufficiently distinct. The fact that other variables besides those included in the research may interfere with the phenomenon of use is not new. What is new is the set of results indicating that the process of information evaluation is not dichotomically dissociated from its relation with knowledge or from its utilitarian or pragmatic relation as perceived individually by the human element. Validity and utility are pertinent constructs related to the study of information use. In in-

formation science there are two distinct views of the phenomenon, which are dealt with as if these constructs were pertinent to different phenomena.

At the practical level, little can be added to what has been said in the literature; application of obsolescence studies is a valid alternative only if the collected data are contextualized at the local point of view and one acknowledges that such studies focus on the Object — document attribute — and not on the information-knowledge fragments.

Theoretically, and within this study's limitation, the obsolescence phenomenon affects Bibliometrics as a specialty. Bibliometric studies postulate that it is possible to infer quality of Content through quantification of the Object characteristics; in other words, it treats information at Shannon's technical level sense (Shannon & Weaver, 1949). Bibliometric studies corroborate a distribution pattern frequently found in social and natural quantification issues: few have many and many have few. Results consistently show that there is a concentration/dispersion mechanism underlying the studied parameters. This quantitative concentration is interpreted as the channel's (literature) capability to transmit high-quality parameter information, as defined by the parameters studied; that is, Shannon's effectiveness level is inferred by the technical level.

The same reasoning is being applied to obsolescence studies to infer information value; here the effectiveness level is taken as an entry point to the communication system — in this case, translated by the citation's age concentration. One measures Object use and infers Content quality by concentration of Object age. Nevertheless, this inference is based on two false premises: The first is to suppose that Object and Content are equivalent entities; the second is the fallacy of affirming the consequent (i.e., that the relation object-content-use can be altered and Content quality could be inferred by measuring the Object). The present results, although not generalizable, oppose these statements and show that information value is not necessarily associated to the age of the document. In others words, in Bibliometrics, the phenomena studied are physical; in obsolescence, on the contrary, the issues are not physical (cognitive, psychological, social, etc.) as demonstrated in this study. Accordingly, there is a need to redirect obsolescence studies, and by extension, information use studies, in order to get a better understanding of what is focused: information use and its absorption as personal or social knowledge.

One way of doing it is to adopt a cognitive viewpoint and to study, at the macro sociological level, the dynamics of priorities that each user applies in evaluating information. It should be acknowledged that there is a multidimensional state where the phenomenon occurs and that, in that context, information is evaluated through generating a pattern of multiple relationships. Notable examples of this kind of study are Ingwersen (1982), Wilson and Streatfield (1977), and Belkin *et al.* (1982), among many others.

It may be suggested that the cognitive point of view is a very promising way to relate and integrate a variety of use studies in information science. If we really want to understand the processes underlying information evaluation that are associated to information use, it will be entirely inadequate to accept the definition used in Shannon's theory. Focus should be upon the meaning of the message and its effect on users. The ways information is perceived and used are legitimate problems to those interested in information communication and use.

REFERENCES

Bailey, K. D. (1978). Methods of social research. New York: Free Press. London: Macmillan.

Belkin, N.J.; Oddy, R.N.; Brookes, H.M. (1982). ASK for information retrieval. Part. 1-2. *Journal of Information Science*, 38:61-71, 145-164.

Böhme, G. (1977). Models for the development of science. In J.S. Rösing & J. de D. Price, (Ed.), *Science, Technology and Society* (pp. 319-349). London: Sage.

Brookes, B.C. (1975). Aging of scientific literature: Letter to the editor. *Journal of Documentation, 36*(12), 164-165.

Brookes, B.C. (1981). The foundations of information science: Part IV: *Journal of Information Science, 3*(1), 3-19.

Brookes B.C. (1970). The growth, utility and obsolescence of scientific periodical literature. *Journal of Documentation, 26*(4), 283-294.

Burton, R.E., & Kleber, R.W. (1960). The half-life of some scientific and technical literatures. *American Documentation, 11*(1), 18-22.

Gapen, D.K., & Milner, S.P. (1974). Obsolescence. *Library Trends, 30*(91), 107-124.

Ingwersen, P. (1982). Search procedures in the library—analysed from the cognitive point of view. *Journal of Documentation, 38*, 165-261.

Kuhn, T. (1970). *The structure of scientific revolutions*. Chicago: Univ. of Chicago Press.

Line, M.B., & Sandison, A. (1974). Obsolescence and changes in the use of literature with time. *Journal of Documentation, 30*(3), 283-350.

Mikhailov, A.I.; Chernyi, A.; Giliarevskri, R.S. (1984). *Scientific communication and information*. R.H. Burger (Trans.). Arlington: Information Resources Press.

Motylev, V.M. (1981). Study into the stochastic process of change in literature citation pattern and possible approaches to literature obsolescence estimation. *International Forum on Information and Documentation, 6*(2), 3-12.

Polushkin, V.A. (1977). The concept of information aging. *Nauchno-TeknichesKaya Informatsiya*, Series 2, *11*(4), 10-11.

Rawski, C.H. (1977). The scientific study of subject literatures. *Visible Languages, 11*(1), 5-23.

Repo, A.J. (1986). The dual approach to the value of information: An appraisal of use and exchange values. *Information Processing & Management, 22*(5), 373-383.

Saracevic, T. (1970). The concept of relevance; introduction. In (Ed.), *Introduction to Information Science*. New York: R.R. Bowker.

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

Wilson, T.D., & Streatfield, D.R. (1977). Information needs in local authority social services departments: An interim report on Project INISS. *Journal of Documentation, 33*, 277-293.

Zunde, P., & Gehl, J. (1979). Empirical foundations of information science. *Annual Review of Information Science and Technology, 14*, 67-92.

APPENDIX A

Papers in P3

Brookes, B.C. (1968). The derivation and application of the Bradford—Zipf distribution. *Journal of Documentation, 24*(4), 247-265.

Dennis, W. (1964). Productivity among American psychologists. *American Psychologist, 9*, 191-194.

Karel, L. (1967). Selection of Journals for Index Medicus. *Bull. of Medical Library Ass., 55*, 259-278.

Kessler, M.M. (1963). Bibliographic coupling between scientific papers. *American Documentation, 44*(1), 10-25.

Leimkuhler, F.F. (1967). The Bradford distribution. *Journal of Documentation, 23*(3), 509-514.

Pelz, D.C., & Andrews, E.W. (1964). Diversity in research. *International Science and Technology 31*:28-36.

Price, J.D., & Beaver, D.C. (1966). Collaboration in an invisible college. *American Psychologist, 21*, 1011-1018.

Zenner, C. (1968). An analysis of scientific productivity. *Appl. Mat. Sci, 59*(4), 1078-1081.