Studying the Value of Library and Information Services. Part I. Establishing a Theoretical Framework

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> Of everything which we posses there are two uses. Both belong to the thing as such, but not in the same manner . . . . For example, a shoe is used for wear, and is used for exchange; both are uses of a shoe.
> Aristotle. *Politics.* Book I. Ch.9

> The word VALUE it is to be observed has two different meanings, and sometimes expresses the utility of some particular object and sometimes the power of purchasing other goods which the possession of that object conveys. The one may be called ''value in use''; the other, ''value in exchange.''
> Adam Smith. *An inquiry into the nature and causes of the wealth of nations.*
> Ch. IV. *On the origins and use of money.*

This report is derived from a large study sponsored by the Council on Library Resources. Two of the objectives of the study were to develop a taxonomy of value-in-use of library and information services based on users assessments and to propose methods and instruments for similar studies of library and information services in general. The corresponding results are reported in two parts. In this, the first part, we discuss underlying concepts related to value that must be clarified in order to proceed with any pragmatic study of value, and we establish a theory of use-oriented value of information and information services. We examine the notion of ''value'' in philosophy and economics and in relation to library and information services as well as the connection between value and relevance. We develop two models: One related to use of information and the other to use of library and information services. They are a theoretical framework for pragmatic study of value and a guide for the development of a *Derived Taxonomy of Value in Using Library and Information Services.* In the second part of this report, we present the methodology employed in development of the Taxonomy, the Taxonomy itself, and the results of testing the Taxonomy. We believe that the Taxonomy covers most dimensions of value related to use of library and information services. In the second part we also present suggestions for pragmatic applications of the Taxonomy.

1. Introduction

1.1 Organization of the Report

We report on an empirical study of value of library and information services which resulted in a *Derived Taxonomy of Value in Using Library and Information Services* (later simply called Taxonomy). The term ''derived'' in the name of the Taxonomy reflects the fact that it is derived from what users had to say about the value of services received. To provide the framework for the study we also address several questions that immediately come to mind:

- Why is it important to study value of library and information services?
- What is ''value'' anyway?
- What constitutes value in relation to information and information services?
- Is there a fruitful theoretical framework and approach for study of value of such services?

In this, Part I of the report, we address the above questions. The first question, about importance, is addressed directly in the Introduction and indirectly throughout many other sections. The second question is addressed in Section 2, where we discuss the treatment of ''value'' in philosophy and economics. The third question, dealing with value of information and development of a model of information use, we address in Section 3, while in Section 4, we relate value and relevance. In Section 5, we describe some related works that dealt with valuing of library and information services. In Section 6, we deal with establishing definitions and a model of use of

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library and information services. Together, the elaborated concepts and the models serve as a framework for *a theory of use-oriented value of library and information services.* Part II of the report is devoted to the study proper: Importance of taxonomies; methodology for collection and analysis of data; presentation of the resulting Taxonomy; statistical tests of the Taxonomy; and practical and theoretical implications. In Part I, we often refer to a variety of dimensions of value in use of library and information services. The Taxonomy presented in Part II shows these dimensions or facets in detail.

Clarification of the value of library and information services requires three steps. In the first step, attributes or dimensions of value must be identified and organized in some rational structure. In the second step, procedures for appraising value according to each of these dimensions must be developed. Finally, in the third step, data must be collected and analyzed following the dimensions and procedures identified in the preceding steps. Both parts of this study address in depth the first step only while making a few suggestions for the second and third. We believe that the theoretical concepts presented in Part I, and the pragmatic aspects, the Taxonomy, in particular, presented in Part II, can be generalized. They provide a foundation for the second and third step, namely for development and conduct of pragmatic studies of the value of library and information services.

1.2 Importance of Study of Value

Clearly, libraries and information systems, and the services they provide, have been valued for a long time. They were supported by society, communities, organizations, institutions, and users because it was implicitly believed or explicitly stated that they provide unique value, most often intangible or even symbolic, rather than monetary in nature. Recently, the importance and urgency of determining value of library and information services in a more utilitarian, explicit, and specific way have increased for a number of reasons.

First, the social role of information is changing, represented by the evolution of the ''information society.'' Information is assuming an ever more central role in every aspect of life. As a consequence, roles of and expectations for library and information services are also changing.

Second, libraries and information centers are in transition along several dimensions. They are shifting from the ''just-in-case'' model of collection completeness to the ''just-in-time'' model of providing access to information resources located anywhere. Electronic information resources and networks are providing new ways of access and use.

Third, many new ''players,'' enabled by modern information technology and networks, are beginning to provide information services—and they are competing directly with libraries and information centers. This growing competition for the consumers' and funders' resources confronts libraries and information systems with heightened need for justification and valuation.

All this means that we must address *explicitly* the issue of value provided by the services offered. Increasingly, services have to be justified with hard data. Justifications to funders—institutions, organizations, communities—have to include plausible, believable demonstrations of value that library and information services provide.

Yet value is a complex proposition, difficult to deal with in both theory and practice. It is hard to specify what is meant by value in relation to library and information services. Despite a large literature on the subject, no agreement on basic concepts has emerged and no adequate theory of value for such services exists. It is even harder to develop and apply theory-based methodologies for pragmatic collection of data. It is no wonder then that only a few studies have reported actual data related to value in library and information services.

1.3 Objectives of the Study

This section appears in both parts of the report in order to make them self-contained. This report is a result of a 15-month study sponsored in large part by the Council on Library Resources. The goal of the study was to address the problem of developing models and methods for studying the value and cost of library and information services in a way that can be pragmatically generalized and applied by services wishing to conduct similar studies. The practical aim of the study was to provide libraries and information systems in general, and those oriented toward research, such as large research libraries, in particular, with methods for gathering information on value and cost of their services—information that will aid in justification and decision making. In the process, we also worked toward a theoretical framework for value in library and information services. The objectives of the study were to develop and test a taxonomy of value of library and information services based on user assessment, determine costs associated with specific services, develop methods for combining and correlating cost and value data, and provide detailed descriptions and manuals that will allow for replication of these types of studies.

This report is one in a series of papers on the study. The report is devoted and restricted to reporting on the *first objective only, that is, the report deals with framework and description of value only.* Subsequent and related papers deal with costs and with correlation of costs and value (Abels, Kantor, & Saracevic, 1996; other articles are in preparation). A progress report on the study, which can be considered the predecessor of this paper, was presented at a conference (Kantor & Saracevic, 1995).

Achievement of these objectives required an empirical project and study, involving collection and analysis of a

large amount of data from a number of different services at several research libraries, as described in Part II. Details of the project, (including rationale, methods, and results, plus appendices presenting instruments, procedures, and manuals for use in replication) are presented in the project's final report (Kantor, Saracevic, & D'Esposito-Wachtmann, 1995). A manual for application of the Taxonomy is presented separately (Huttenlock, Dawson, Saracevic & Kantor, 1995).

2. What is " Value?"

The difficulty in dealing with value of library and information services parallels the problems and ambiguity in treatment of value in other fields and in pragmatic situations. Value has many dimensions, attributes or predicates. Dealing with value is a challenge in any field. Yet, in any consideration or model of individual, organizational, or social behavior based on human intentionality, value is an indispensable intermediating concept for establishing and guiding actions, relations, priorities, and exchanges. We turn to philosophy and economics to clarify the meaning of value. We synthesize some of the major views from these two fields that seem most relevant and useful in establishing a framework for study of value in library and information services.

2.1 Views in Philosophy

As a fundamental human notion, the concept of value has challenged philosophers from antiquity to today. Philosophers consider value as the worth of something, and the process of valuation as an estimate, appraisal, or measurement of its worth. In their works, worth seems to be an undefined primitive term. They consider that value is related to, but not synonymous with, ''good,'' ''desirable,'' or ''worthwhile,'' and that it can be positive or negative. The theory of value, or axiology, is the branch of philosophy that deals with the nature of value and valuation.

One persistent concern has been to distinguish various types or dimensions of value, as exemplified by the leading quotes in this part by Aristotle and Adam Smith. Their classification, distinguishing between *value-in-use* and *value-in-exchange*, is still valid. However, more elaborate classifications have emerged, which include investigation of the predicates of different types of value (Attfield, 1987; Perry, 1954). In philosophy, it is now common to distinguish among:

- *Intrinsic value,* being good or worthy in and of itself. It is basic to all the others. Health or good experiences might be considered as intrinsic values.
- *Extrinsic or instrumental value,* which is a means to, or contributes to something that is intrinsically valuable. Often relates to an activity. An example might be exercise that contributes to good health.
- *Inherent value,* something whose experience, contemplation, or understanding contributes to intrinsic value. Often relates to an entity. An example might be aesthetic value of a work of art that contributes to good experiences.
- *Contributory value,* something that contributes to the value of a whole of which it is a part and which may be contingent on the existence of other parts or activities. Often relates to a constituent. Utility or usefulness of a product used for a given purpose might be an example.

Let us now extend these concepts to information and to information services:

- If ''being informed'' has intrinsic value, similar to health or good experiences, then we may consider that information may have extrinsic or instrumental value because it may contribute to or advance a person's state of ''being informed'' (or better informed).
- An information service has contributory value if it provides such information. In particular, it may have contributory value if the information provided is connected to some application or decision by an informed person.
- Finally, something that may ''carry'' information, such as an information object (i.e., an object potentially conveying information), a well-written article, or a well-designed book, may have inherent value.

In other words, the value of being informed is intrinsic. The value of information is extrinsic or instrumental. The value of an information service is contributory. The value of an information object may be inherent. While these are not the same, they are closely related. The subtle differences and relations are a source of endless difficulties, even confusion. We further elaborate on value of information in Section 3 and on value of information services in Section 6.

It is hard to show the intrinsic value of being informed or the inherent value of an information object. It is somewhat easier to observe the extrinsic or instrumental value of information, and the contributory value of an information service, when it provided information to a user who may become better informed. It is also somewhat easier to observe the contributory value of an information service, when information provided serves as a means to a given end, and is being related to that end—such as information of utility in decision making. This last aspect of contributory value is a most important concept when studying value of library and information services.

The importance of establishing the context for value and the study of value involving people has also been considered in social theory by Nobel laureate, Gunnar Myrdal:

> A value premise should not be chosen arbitrarily: It must

> be relevant and significant in relation to the society in which we live. It can therefore, only be ascertained by an examination of what people actually desire. (Myrdal, 1958, p. 2).

These considerations contribute to our framework, as elaborated below. We make distinctions between value of information and value of information services, and on basis of that we establish models of use of information and use of information services. We consider value in relation to a context. We study what users had to say about value, and we build a faceted model on which the structure of the Taxonomy is based.

2.2 Views in Economics

The economists consider value as the worth of something that contributes to wealth. It is a concept at the foundation of economics. Adam Smith's classification of *value-in-exchange* and *value-in-use* remains valid, with, of course, some modern elaboration on the theme. Dealing with measurement of value-in-exchange in economics is considerably easier then in other fields because (as explained by Nobel laureate R.H. Coase in a 1975 talk aimed toward librarians):

> The great advantage economics has possessed is that economists can use the 'measuring rod of money'. (Coase, 1994, p. 44).

Unfortunately, in considering value of information and of information services this measuring rod can not be easily applied. For most library and information services, there is not a market in the economic sense where money is exchanged directly, and hence we cannot use the measuring rod of money. Other rods are necessary. For the most part, we must instead deal with the value-in-use.

Value-in-Exchange. Two distinct sets of economic theories related to value have emerged following the in-exchange and in-use classification. In the first set, there are a number of elaborations, some with considerable sophistication and formal reasoning, that relate exchange value to prices of commodities resulting from interactions in a market economy. In a classic formal treatment the Nobel laureate G. Debreu (1959, p. 1) calls it ''theory of value,'' while dealing with:

> . . . price system or value function defined on the commodity space: (1) explanation of the prices of commodities resulting from the interaction of the agents of a private ownership economy through markets, and (2) the explanation of the role of prices in an optimal state of economy.

Heilbroner (1988) remarked that such price-oriented theories of value are in fact theories of prices. Their strength is in their concentration on exchange in terms of prices, and as such, these theories were successfully applied in relation to numerous commodities and market analyses. Related to these theories is the often applied technique of cost-benefit analysis, ''[which] is essentially applied price theory, having as its aim the giving of a monetary value to what is gained and what is lost by following a particular course of action'' (Coase, 1994, p. 40). Pragmatically, in the narrower but highly important sense of outlays or investments, exchange value is *measured* in terms of *return on investment*s (ROI), meaning financial (or equivalent) exchanges and returns. The weakness of the exchange (or price) theories of value is first, that they do not involve the second type of value, namely the value-in-use which has also large economic significance, and second, in that they cannot be applied when there is no market involving prices and monetary exchanges, as in cases of many information services.

One of the areas where these concepts, the price exchange-value and cost-benefit analyses in general, and the pragmatic derivations of ROI in particular, have not yet been successfully applied is to information and information services. While organizations, institutions, or communities funding such services would like to have a direct cost-benefits or ROI-type answers to questions about the value received on their investments in the services, this can not be achieved directly (Repo, 1989). The reason lies in the particular properties that make information a unique phenomenon. The notions of ROI and exchange measured in monetary terms alone are not only limiting, but even inappropriate and misleading, when considering services based on information, or many other intangibles involving intrinsic values, such as education, and to related institution such as universities, that provide contributory value. The general question is raised: To what extent can the intrinsic value, such as being informed, and subsequently the extrinsic value, such as information, and the related contributory value of information services, be addressed by economic exchange values? So far, not very well.

Value-in-Use. To address the limitations of exchange or price theories of value, a second set of economic theories emerged based on value-in-use. This was done to extend the economic treatment of value to intrinsic value dimensions such as demands, wants, usefulness, satisfaction, pleasure, pains, and the like. The unifying economic concept called ''utility'' emerged, and the resulting theories are called utility theories. Some of them are formal and very specialized, such as the theory of diminishing marginal utility. As yet, utility theories, while popular with many academic-oriented economists, have had mixed results in market analyses or explanation of economic activities (e.g., Coase, 1994 p. 43, says: ''Up to present it [utility theory] has been largely sterile.''). Still, it is to utility theories and, correspondingly, to value-in-

use, rather than exchange theories and value-in-exchange, that information and information services may be more fruitfully linked, as discussed in some detail later.

Problem of Value. The issue of addressing in some unified way the various economic conceptions of value (such as those represented in exchange theories and utility theories) is a most difficult proposition, as is the same issue in all other areas. Heilbroner (1988, p. 105, 107) discussed the ''problem of value:''

> Is there a *general problematic of value*—a central issue that can be discerned within the wide spectrum and definitions and conceptions that the subject embraces? . . . *The general problematic of value, as I see it, is the effort to tie the surface phenomena of economic life to some inner structure or order.* . . . Value theory is . . . the search for processes or structures that impart orderly configuration to the empirical world, akin to arcs created in iron filings under the influence of a magnet. (Emphasis in the original).

The same difficulty is experienced when investigating the value of information services. Our study is indeed restricted to the surface phenomena of information use. However, in specifying a framework and deriving a Taxonomy, we are providing tools for possibly going beneath the surface.

What Creates Value? Turning from specific attributes to broader concerns of externally visible consequences we see that value in economics is related to creation of wealth. The question that economists addressed from Adam Smith on is: *What creates wealth or what creates economic value?* The traditional answer to this question was that value is created by land (natural resources), labor and/or capital, to which later was added management. Some theories stressed labor (e.g., Marx), others capital, while most contemporary, capitalist theories include a combination of all. With the evolution of the social order to a ''postindustrial'' society (Bell, 1973), or ''postcapitalist'' society (Drucker, 1994), or what we now commonly also call ''information society,'' a differing set of contributory factors has emerged:

> The basic economic resource—'the means of production,' to use the economist's term—is no longer capital, nor natural resources (the economist's 'land'), nor 'labor'. *It is and will be knowledge.* . . . Value is now created by 'productivity' and 'innovation', both applications of knowledge to work. The leading social group of the knowledge society will be 'knowledge workers'—knowledge executives who know how to allocate knowledge to productive use, just as the capitalists knew how to allocate capital to productive use; knowledge professionals, knowledge employees. . . . The *economic* challenge of the post-capitalist society will therefore be the productivity of knowledge work and knowledge worker. (Emphasis in the original) (Drucker, 1994, p. 8).

The phrase ''post-anything'' suggests transition. Postindustrial or postcapitalist denotes a society in transition. Economic thought on value is also in transition. Answers to what constitutes value are being modified—this is included in the challenge issued by Drucker. If we accept Bell's and Drucker's premise that knowledge (and by extension information) is becoming central to the emerging social and economic order, then it follows that *value of information is increasing and changing significantly.* This has enormous implications for library and information services. However, this does not mean that they are *suddenly,* and *in present configuration,* being thrust into a central social role. Not at all. It means that they face many challenges, as do other institutions in transition. Defining their own value is one of them.

3. Value of Information

In this section, we consider approaches to study of the value of information. We synthesize the approaches to studies of value of information in economics and adapt them to information as obtained by users from library and information services. To do that, we develop a model of use of information and then provide a rationale for application of that model. We make a distinction between value of information and the related model of information use as presented in this section, and value of information services and the model of use of information services as presented in Section 6. The reason for developing a model of use of information, and later of use of information service, is simple and direct: In order to deal with value-in-use of information and of information services we first have to establish the elements or dimensions of use. We assume that value is related to use. This is our central premise.

3.1 What is Information?

First, of course, we have to face the issue of what is meant by information. A number of interpretations exist, which are assumed in a given treatment of the value of information. We can present them on a scale in which information is dealt in three senses. On the one and most restrictive end of the scale, information is considered exclusively as a property of the message (text, record, document ...). As an example, Shannon's theory of information assumed this interpretation.

Further on, in a broader interpretation, information is considered in connection with cognition. It results from interaction of two cognitive structures, a ''mind'' and (broadly) a ''text.'' Information is that which affects or changes the state of a mind. In cases of information services, information is most often conveyed through the

medium of a text, document, or record, e.g., what a reader may understands from a text or document. The interpretation by Tague-Suitcliff (1995, p. 11–12) fits:

> Information is an intangible that depends on the conceptualization and the understanding of a human being. Records contain words or pictures (tangibles) absolutely, but they contain information relative only to a user. . . . Information is associated with a transaction between text and reader, between a record and user.

Still further on and in the broadest sense information is related not only to the cognitive structures but also in addition to motivation or intentionality, and therefore it is connected to the expansive social context or horizon, such as culture, work, or problem-at-hand. From the point of considering value of library and information services, we must also include such a context and thus treat information in this broadest interpretation.

In defining our framework for study of value, we consider both the second, interactive- and cognitive-based conception of information, and the third conception, of information also in a context represented by intentionality in relation to some reason, task, or problem-at-hand. In other words, we suggest that in the study of value of information and value of information services we cannot treat the ''message in isolation;'' we must consider information in its cognitive and contextual sense.

3.2 Approaches to Study of Value of Information

The issue of value of information has been addressed in a few fields, but primarily in the works related to economics of information. Following the classification of Ahituv and Neuman (1986, ch. 3) approaches to value of information can be distinguished into:

- *Normative value approach:* Application of formal and rigorous models involving information uncertainty and/or utility in relation to decision making. The approach is based on a number of underlying assumptions which place significant restriction on type of information considered and type of applications in real situations.
- *Realistic value approach:* A before and after approach measuring the effect of information provided by new (or given type of) information services on the outcomes of decisions and/or performance of decision makers. Together with the normative approach, this approach assumes information as an exclusive, identifiable variable and shares the difficulty of resolving it from other or intervening variables that also affect the complex process of decision making.
- *Perceived value approach:* Subjective valuation by users of information, of the value or benefits of given information. This assumes that users can recognize the value of information (or the benefits gained/lost). If scales are used, it assumes that they can place the value in some ranking or, if monetary terms are used, that they can translate the value into monetary units.

The three approaches form a scale in terms of restrictions. The first approach, the *normative value approach*, is by far the most rigorous; it achieves the rigor by being most restrictive. In measuring information, by necessity, it takes the narrowest view of information. That is, it narrowly restricts the attributes of information and the context of measurement, to the exclusion of broader attributes and aspects (as discussed above). In contrast, we believe that information, in respect to its use in the context of real (as opposed to abstract) decision making and as provided by information services, incorporates the broader aspects. As desirable as its rigor is, the normative approach has not yet been successfully applied in theory or practice related to value of library and information services (Repo, 1989).

The *realistic value approach* has fewer restrictions on the type of information and information services applied and less rigor. It has been applied, in a number of variations, in valuation of library and information services. These are reviewed in surveys of studies on economics and/or value of library and information services by King, Roderer, and Olsen (1982), Cummings (1986), Koenig (1990), and Feeney and Grieves (1994); Repo (1989) deals comprehensively and critically with a variety of approaches to and studies of the value of information in economics proper.

When we go to the other end of the scale, to the *perceived value approach*, we loose the rigor and precision, and, moreover, we have great difficulties in dealing with what has been called ''an untidy collection of dissimilar attributes.'' However, we gain by admitting the judgments of the users, who after all, are the immediate recipients of an information service. Using this approach, several studies (reviewed below) involved users in valuation of library and information services. Ours continues this line of research.

As long as the assumptions, and the ensuing limitations, advantages, and disadvantages, of all the approaches are understood and not ignored, one can proceed with any approach and/or interpret the results from a study taking the assumptions of a given approach into account. But to underscore: the assumption of what is meant by information, and the restrictions of a given approach have to be recognized.

3.3 Normative Approach

Because of its rigor and desirability, let us review the normative approach in some detail to see what we can adapt from the concepts and rigor. The advances in the theory of uncertainty and information, an area in the economics of information, have been surveyed by Hirshleifer and Riley (1992). It may have a potential for develop-

ment of a theoretical framework for the study of value of information. The theory provides:

> . . . a rigorous foundation for the analysis of individual decision-making and of market equilibrium under conditions where economic agents are unsure about their own situations and/or about the opportunities offered them by market dealings. . . . A first fundamental distinction is between the economics of *uncertainty* and e*conomics of information.* In the economics of uncertainty, each person adapts to his or her given state of limited information by choosing the best 'terminal' action available. In the economics of information, in contrast, individuals can attempt to overcome their ignorance by 'informational' actions designed to generate or otherwise acquire new knowledge before a final decision is made. (Emphasis in the original) (ibid. p. 1–2).

The authors provide following examples. In the economics of uncertainty, an individual is assumed to act on the basis of current *fixed beliefs,* e.g., deciding to whether or not to carry an umbrella based on one's present estimate of the chance of rain; while in the economics of information, a person typically is trying to arrive at *improved beliefs,* e.g., by studying a weather report before deciding to take an umbrella. Information may be considered as causing a difference between fixed and improved beliefs or, in cognitive terms, between different states of knowledge of the decision maker. The value of information is calculated as the difference between the (decision maker's) expected utility of the decision made without the information and the expected utility of the best possible choice in decision made after receiving and analyzing the information. In other words, *the value of information rests with improvements in decision making.* Individuals may to some extent overcome their ''ignorance'' or uncertainty by some informational action, such as using an information service. These decision-theoretic approaches have been applied to analyses of share-prices, sales revenues, accident-prevention measures, and similar situations where information has restricted attributes and defined utility.

The ''expected utility'' measures used in this treatment to express the value of information are based on probabilities, and on formal probabilistic reasoning. These are powerful tools used in many areas with great success. However, use of such tools requires two key assumptions, rarely discussed. First, it assumes that the decision maker can in fact select the *best* decision with or without the information. As mentioned, this restricts the type of ''information'' that can be dealt with and excludes other aspects of cognition and reasoning and other variables that enter into decision-making, e.g., by assuming a direct, linear connection between information and decision, as in report on weather and decision on umbrella. Second, it assumes that a decision maker, can indeed assign utilities and probabilities.

The theory provides a useful distinction between a ''message'' and a ''message service'' or, in our parlance, between information and information service. ''Since you can never know in advance what you will be learning, you can never purchase a *message* but only a message service—a set of possible alternative messages'' (ibid. p. 168). Let us now explore the value of information, with a view of adapting some of the concepts elaborated in this section into a theoretical framework. But first, we expand on an important and often confusing relation.

3.4 Relation between Information and Information Services

The relation between information and information service is complex, as is the relation between value of information and value of information services. The information service is the mechanism or organization which provides the information (about the state of the world or public knowledge) to a user. In the cases where the user uses the information for decisions, we may think of the user as decision maker. When it has delivered the information, the information service has completed its role in the process. But the user has not yet performed the cognitive activity (e.g., revising the assessment of the state of the world or enlarging his/her state of knowledge) and has certainly not performed some application based on the cognitive activity. In case of decision making, the application is selecting the best possible decision with some corresponding expected value.

To recognize the distinction *and* the connection between value of information and value of information services, we have developed two distinct, but related models: one of use of information, elaborated next, and the other of use of information services, elaborated in Section 6.

3.5 The Acquisition-Cognition-Application Model of Information Use

We assume that users of an information service are engaged in some task or are dealing with a problem-at-hand that provides the reasons for seeking of information and thus using the service. In other words, we take the third, broadest conception of information, where not only the cognitive and interactive aspects are reflected, but intentionality is involved as well. We then postulate a model of information use. We call it an *Acquisition-Cognition-Application* or A-C-A model. It is our basic or starting model for the study. The model involves three activities or phases in a cycle related to information obtained from an information service:

1. *Acquisition:* The process of getting information or objects potentially conveying information, as related to some intentions.

2. *Cognition:* The process of absorbing, understanding, integrating the information.
3. *Application:* The process of (potential) use of this newly understood and cognitively processed information.

We make a difference between this A-C-A model of use of *information* and a model presented later (Section 6.4) on use of *information services,* which we call the *Reasons-Interaction-Results* or R-I-R model. As already mentioned, but elaborated later, there is a connection but also an important difference between use of *information* and use of *information services,* which is reflected in value assessments and calls for different models. Each model represents through its elements the dimensions or facets involved in assessment of value. *The first (A-C-A) model reflects the facets involved in value of information, and the second (R-I-R) model those involved in value of information services.*

The three phases in the cycle may be bundled together in a short sequence or there may be some period of time that passes between them. *Acquisition* may involve an information service supplying information materials or information. *Cognition* involves some changes in the users' state of knowledge—we do not specify the nature of these changes, if any. There may be a number of types of uses in *Application,* and one of them may be decision-making. The decision-theoretic approach assumes decision-making as *Application.* Typically, the cycle may be repeated several times for the same task or problem, i.e., a user may use a service several times in respect to the same or evolving problem.

3.6 Application of the A-C-A Model

In order to show that the cycle of *Acquisition, Cognition, and Applicatio*n supports establishing value of information even without reference to probabilistic concepts (as in the decision-theoretic perspective of uncertainty and information reviewed above), we consider a typical event of library use in a research library. (The example could be extended to other types of libraries and information centers).

A scholar, (he or she, for simplicity to be referred later with a generic he) comes to the library in order to consult some books or articles to better inform himself about the state of knowledge in his or some adjoining field of interest before the task of writing a scholarly paper—such as this one. He may read the books or articles, take them out, or even photocopy certain pages or transcribe passages or phrases by hand. Coming to the library and getting the books (articles) represents the *Acquisition* phase of the cycle.

In the *Cognition* phase, cognitive processes take place, in part during the reading and copying, and continue for some times afterward. At the end, when the scholar commits himself to the *Application* phase, that is to the task of writing, he writes particular thoughts expressed in given words and not others. Introspection reveals that the decision as to which words to write on the paper is enormously complex, influenced by many factors. There is certainly no way in most situations to trace the specific impact of this specific event of library use into the formulation of that paper. Thus, one may argue that it is no use to consider the decision-theoretic perspective in trying to derive value.

Nonetheless, we will argue that it is sensible to consider the decision-making approach in consideration of value but without probabilities and probabilistic reasoning. To help clarify our reasoning we may think of possible decisions as lying in some abstract space of possible decisions, represented in Figure 1.

The sets in Figure 1 are supposed to represent all the possible papers that this scholar could have written on this subject. We can think of them as papers that the scholar could have written on this subject and those that he may reject. One set of possible papers are those that the scholar would have written had he *never come* to the library and looked at those particular books or articles (''options available without library''). The other set of papers are those that he could or might write *after* having made the visit to the library. Now, application of free-will (or pigheadedness) may suggest that the second curve simply encloses the first. That is, having learned more, the scholar could certainly write the same paper he would have written without having learned this or he could write a different one. However, resorting again to introspection, we claim that after the scholar was exposed to certain information, certain lines of writing or expression become unacceptable to him. In other words, there is a region (''options not viable after using the library'') which is contained in the first group and is no longer contained in the second because he would be embarrassed or would feel that he was misstating the case if he wrote them. Correspondingly, there is some set of alternative expressions (including at the minimum quotations from or references to new materials gathered) which is available to him now and was not available before. These represent items which are in the second group but are not in the first group.

To be somewhat more rigorous about it, if we suppose that all of the items that are newly available are at least as good as any of the alternatives which he now finds unacceptable, then we feel comfortable in claiming that the visit to the library has increased the value of the paper that will be written by this scholar. We do not need a complex probabilistic framework, but simply reason as in the next paragraph.

The new paper may be written from the newly acquired alternatives. And, correspondingly, it is not written from the group of alternatives now considered unacceptable. On a pair-wise comparison, no matter which of these

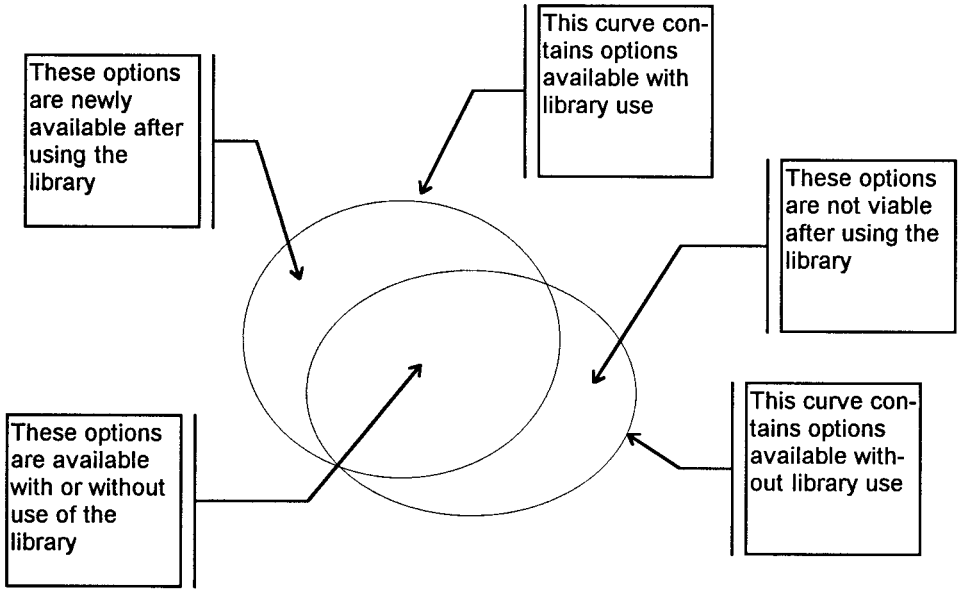

FIG. 1. The range of possible actions available to a user before and after making use of a library or information service represented symbolically by two overlapping figures, defining three different regions.

uncountable number of alternatives is chosen, the paper will be better because of having visited the library, than it was without. On the other hand, the new paper may be written among the range of possibilities which belong to both groups. In this case, the visit to the library has perhaps no effect at all.

Thus, without resorting to explicit computation of any kind of utility measure, we can nonetheless say that the information gained from a library exhibits its value in the *Application* and the final product (in this case the writing of a paper) even though we cannot specify that action as a decision chosen from some small finite list.

In this way, we can separate the information service from information and consider the problem of valuing the information service itself without valuing information independent of users and services to users. It is helpful to consider other such pairs. For instance, health services are evaluated in ways that do not require us to assign value to health itself. Financial services are evaluated in their own complex ways without resorting to the value of finances. This is the justification of the approach taken in this study.

4. Relevance and Value of Information

Relevance is a key notion in information science because it is central in design and evaluation of information retrieval (IR) systems and techniques. It is also a complex phenomenon with a long and even turbulent history in information science, going back to early 1950s (for a review, see Saracevic, 1975 and Schamber, 1994).

In general, relevance, according to Webster, means having significant bearing on matter at hand. As many other concepts, relevance assumes related but more specific meaning in more specific contexts and applications. In the context of human communication, relevance is the attribute or criterion reflecting the effectiveness of exchange of information between people (or people and objects) in communication contacts. This effectiveness involves cognition and cognitive structures *and* communication as a complex interactive process. In applications related to information systems and IR, *relevance is the attribute or criterion reflecting the effectiveness of exchange of information between people (i.e., users) and information systems in communication contacts, based on valuation by people.*[1] Given the dynamic nature of information exchange and communication in general, relevance becomes ''. . . a dynamic concept that depends on users' judgment of the quality of the relationship between information and information need at a certain point in time'' (Schamber, Eisenberg, & Nilan, 1990).

With relevance as the criterion and human judgments of relevance of retrieved objects (such as documents, texts, data, images, . . .) as measuring instrument, the measures of precision and recall[2] are widely used in evaluation of IR systems. The strength of these measures is

[1] To clarify the use of terms ''attribute/criterion,'' ''measure,'' and ''measuring instrument'' with an example: length may be an attribute, inch a measure, and a ruler is a measuring instrument. Relevance is an attribute/criterion, precision and recall are measures, and users are instruments for measuring.

[2] Precision is the probability that given that an object is retrieved it is relevant or the ratio of relevant objects retrieved to all objects retrieved. Recall is the probability that given that an object is relevant it is retrieved or the ratio of relevant objects retrieved to all relevant objects in a file.

that they involve people—users—as judges of effectiveness of performance. The weakness is the same: It involves judgment by people, with all the perils of subjectivity and variability.

Relevance indicates a relation and so does value, as discussed below. For relevance, many relations have been investigated. An (uneasy) consensus has emerged in information science that operationally we can distinguish between three relations that account for three facets (sometimes called types) of relevance:

- *Topical relevance:* Relation (degree of correspondence) between the topic(s) expressed in the query posed to an information system and the topic(s) covered by the retrieved objects, or more broadly by the objects in the file(s) of the system.
- *Cognitive relevance:* Relation between the state of knowledge and cognitive information need of a user and the objects provided or in the file(s) of the system.
- *Situational relevance or utility:* Relation between the task or problem-at-hand and the objects retrieved (or in the files). Relates to usefulness in decision-making.

Practically, IR systems assess topical relevance only—that is they respond to queries—hoping that the objects retrieved may also be of cognitive relevance and even more so of utility. However, a user may judge an object by any or all facets or types of relevance—for a user the three facets interact dynamically. Difficulties arise when an object is of topical relevance but not of cognitive relevance or utility, or conversely. If items are of cognitive relevance or utility but were not reflected in the query, they are not and cannot be retrieved. A variety of query treatments (user modeling, query expansion based on relevance feedback, etc.) have been instigated to overcome these difficulties with the object to have the query reflect as closely as possible cognitive relevance and/or situational relevance/utility. For example, a number of dynamic IR techniques (reviewed by Kantor, 1994) have been developed with an aim to provide IR systems with some chance to discern the cognitive and/or situational state of the user. However, automatic user modeling in this sense has not progressed very far as yet.

We can connect the three facets of relevance in IR to a much broader perspective. In philosophy, Schutz (1970) dealt extensively with relevance as a property that determines the connections and relations in our social world. He suggests that a person at some moment has a ''theme''—the present object or aspect of concentration—and a ''horizon''—physical space, own experiences, social background—that are potentially relevant to the theme. Subsequently he defined three basic and interdependent types of relevance which are in dynamic interaction in a ''system of relevances:''

- *Topical relevance:* Perception of something being problematic, what is separated from the horizon to form a theme. E.g., from the point of view of a reader and a book, the part of book that a user decides to read has topical relevance.
- *Interpretive relevance:* Involves the horizon, the stock of knowledge at hand, past experiences and the like, in grasping the meaning and to which the topical theme may be compared.
- *Motivational relevance:* Involves selection. Which of the several alternative interpretations are selected? Refers to the course of action to be adapted.

While Schutz dealt with a much broader arena than information science and concentrated on people and their relation to the social world in which they live, the categories he suggested correspond nicely to the operational facets of relevance distinguished in information science. They represent a selection of the topic or problem-at-hand, the cognition in interpretation, and the consequent selection of interpretation and/or action.

It is the last facet or type of relevance, namely *situational relevance* or *utility* in information science, and *motivational relevance* by Schutz that corresponds to value-in-use of information, as discussed in the preceding section. In a number of respects, they are the same. However, value-in-use has a number of dimensions that relevance does not cover, and, moreover, it does not start from relevance assumptions. Still, we can argue the following: Anything (information or objects potentially conveying information) provided by a library or information service should be *relevant first in order to become of value.* In other words, relevance and value are connected. Thus, questions of relevance must be raised when reflecting on value. However, relevance, even though involving users, is much more operational and tied to the system, while value involves many more dimensions related to user intentions, experiences, interaction with the system, and utility and use of results.

To underscore, while value and relevance are distinct, they are also related. This relation motivates a number of questions about relevance that we asked in the interviews of users while exploring their perceptions of value. It also motivates a number of specific categories in our Taxonomy presented in Part II. But the fact that relevance is not equivalent to value motivates additional questions in interviews of users, and additional dimensions or facets in the Taxonomy, that are not related to relevance.

5. Valuing of Library and Information Services

5.1 Evaluation Criteria—Their Relation to Dimensions of Value

Libraries have a long tradition of evaluation, which started with the emergence of modern librarianship at the end of the 19th century, and concentrated for a long time thereafter on evaluation as to compliance with established

standards and best practices, related to holdings, representation, arrangements, space, staff, operations, etc. Criteria derived from standards and best practices did not reflect dimensions of value. Evaluation of IR systems began in the 1950s and concentrated mostly on relevance. By the end of the 1970s, a number of studies have emerged that used diverse perspectives and criteria for evaluation of libraries and information systems (King, 1978). The approaches to evaluation of library and information services have been often dichotomized into system- and user-centered (Dervin & Nilan, 1986). While there is and shouldn't be any conflict between the two—they are very much related—there is a strong school of advocacy for the need for user-centered evaluation, as articulated by Orr (1973) and, more recently, by Bawden (1991).

User-Centered Studies. Such studies have been conducted using a variety of criteria and associated measures, among them: *satisfaction, success, utility, relevance, completeness, specificity, accuracy, timeliness, impact, effort, difficulty, failure, frustration, and the like* (Baker & Lancaster, 1991; Kantor, 1984; Robertson & Hancock-Beaulieu, 1992; Saracevic, 1995; Saracevic & Kantor, 1988). A number of these criteria and associated measures reflect one or another dimension of value, but multiple dimensions are needed to capture the richness of value-in-use. In this study, we are interested in using users' evaluation to assess systems services and results, involving a number of dimensions, as reflected in the Taxonomy presented in Part II.

More recently, Tague-Suitcliffe (1995) isolated the cognitive aspects and used the criterion of ''informativeness'' as a base for a formal evaluation of information services. To derive a measure for evaluation, she concentrated on the records or sources of information and considers their informativenes, i.e., their ability to provide information to a user:

> We say one text contains more information, is more informative, for a reader than another text. . . . We mean that, in some sense, one text helped us understand an issue or problem better or taught us more about a subject than did the other (ibid. p. 15).

Informativeness is another dimension that is related to value. Intuitively, informativeness has a great appeal to be considered not only as one dimension, but a major dimension when we consider the value of records or documents provided by information services. If one could operationalize the formal framework that she developed for measuring informativeness, then this will be a significant contribution toward measuring the dimension of value that is reflected by informativeness.

System-Centered Studies: Value-Added Model. As mentioned, libraries have been evaluated from the systems perspective on the basis of standards and best practices, but the criteria used have no relation to value. However, value of libraries and information systems has also been treated from the system perspective by considering the criterion of value-added, which is well developed in economics. We need to clarify the distinction and relation between the value-added and value-in-use approaches.

Taylor (1986) has proposed that libraries and information centers ''add value'' to information and/or information resources. This aspect of value is connected directly to operations of libraries and information systems rather than to users. Libraries add value by variety of operations, which may be conveniently grouped into collection (developing a collection of records, or a file), description (classification, indexing, and other identifications), access (including provisions for searching and retrieval), and presentation/dissemination. The stress is on trying to appraise the value that is added to information or information objects *by* libraries and information systems. It is a useful notion in resolving library activities into diverse functions. But, value considered in terms of value-added assumes and implies potential users and use, but does *not concentrate on value as experienced by users.* The processes or functions of libraries and information systems enter only indirectly in the users' perception and dimensions of value, and users can rarely discern them. Users are not a good focus for study of value-added processes. Thus, other theoretical constructs, and other criteria and measures of value are needed, if we are to consider users and use.

The value-added model is not rejected here; its application to library functions is considered appropriate. However, the model is simply considered inappropriate when considering users, as we did in this study. In the *Acquisition-Cognition-Application* model of use of information, these value-added processes serve to facilitate *Acquisition,* by the user of the (needed or sought) information or information objects. Unfortunately, despite a substantial literature on value-added processes of libraries and information systems, there has been not much progress in measurement based on empirical evidence.

5.2 Representative Studies

We do not provide a comprehensive review here, because of space restrictions. The reader is referred to reviews already cited in Section 3.2. We shall mention here only a few studies that (a) contain data and (b) directly relate to our work.

One of the few value-in-use studies of an information service which included substantial empirical evidence related to the description of value was the study of the impact of using MEDLINE by clinicians (Lindberg et al., 1993; Wilson et al, 1989). Based on critical incident technique, the analysis resulted in three taxonomies: reasons why individuals needed information from MEDLINE, impact of information obtained on medical deci-

sion making, and impact on the outcomes of professional activities. This is the study most closely related to our taxonomic efforts, and was an important stimulus for our own work.

There have been a number of studies trying to get at the exchange-value of library and information services, without relying on the rigor of economic theory of the value of information, as discussed in Section 3.3. Perhaps the most representative and best known of these are the studies collecting empirical evidence in a variety of types of libraries by Griffith and King. The chapter by Griffith & King (1994) is a good synthesis of their work with data extracted from a number of studies whose references can be found in the bibliography of that paper. In these studies, they relate value to a variety of measurables and concepts, among them: the ''price'' users pay for library service; cost effectiveness of inputs and outputs; value and characteristics of usage; outcomes, i.e., impacts or consequences of use; and value in relation to domain (e.g., organization, subject) characteristics. Some of these reflect value-in-exchange and others value-in-use. A number of specific categories in our Taxonomy relate to a number of aspects studied by Griffith and King.

5.3 Levels for Study of Value

Valuing of library and information services can be approached from a number of levels. We can divide these into *social, institutional/organizational,* and *individual* levels. Each has differing dimensions of value and calls for different approaches.

Social Level. This level deals with the value that a service provides to the society or to a community. Thus, it is valid to ask about the value of a national library, such as the value of the National Library of Medicine for the pursuance of activities that relate to health or what value a public library has for its community. It is widely agreed that libraries preserve, organize, and disseminate records of a culture and society; thus they have a social, cultural, and educational value proven over millennia. In the sciences, good library and information services are considered indispensable for research. Value on the social level has been observed and justified by long-term experiences and associated cultural and social achievements. However, recently more specific approaches to study of social value have been sought. The approaches taken in such studies concentrate on surveying a representative sample of affected institutions in the area under concern, and/or individuals served, e.g., in the case of the study involving impact of MEDLINE provided by the National Library of Medicine (cited above), this involved survey of a sample of clinicians in the U.S. to derive broader conclusions of the value of the service to health practice in the country.

Institutional/Organizational Level. On this level, we may explore the value of a service (internal or external) for the institution or organization that funds it or houses it and in some other way, supports it. Value should be linked to the mission and progress of the institution (such as education, research, profit through some product or service, etc.). For example, academic libraries are considered to be indispensable for research and education in universities, thus they have a value for the university. Corporate information centers or special libraries provide information that is considered essential for research, management, conduct of business, competitive position, and the like. Thus, they have value for the organization as a whole. Customarily, universities have allocated resources to library and information services (by tradition or formulae) based on long-term experiences and belief in the value of such services to the achievement of their mission. Now they ask for more specific demonstration of value. This new climate calls for approaches using tools of costs and cost-benefit analysis, focus group interviews, management analysis, and user studies.

Individual Level. On the *individual* level, users and potential users are asked their perception of value in relation to given services used or received. Approaches include critical incident analysis, surveys, and interception of users at instances of use to asses value received. Our study is an example.

Connection. The levels are not isolated, they are interdependent. There is a relation between the social or institutional/organizational context of value and individual context. At the end, libraries achieve the social or institutional value through the individuals they serve. This intricate relation was captured by Shera (1972, p. 48):

> [Library is] contributing to the total communication system in society. . . . Though the library is an instrumentality created to maximize the utility of graphic records for the benefits of society, it achieves that goal working with the individual and through the individual it reaches society.

Shera talked about value of the library (or in our conception of library and information services) from the perspective of benefits to the society, but at the same time, he explicitly recognizes the perspective of individuals and implicitly that of institutions. These three contexts are interdependent, but they begin with the individual level. *If a library or information service does not provide value to individuals, even in some historical period or context, it can not and does not provide value on the institutional, or social level.*

Let us turn to universities. Traditionally, universities and other educational institutions were assessed in general terms of value to society. However, in this era of transition

and new economic reality, they are increasingly called to provide different and more specific accounting of their value. Consequently, the universities ask their constituent parts, libraries included, to account differently and more specifically. We all have a very hard time in doing this. A university does not conceive of itself in terms of producing widgets or having manufacturing divisions or product lines. So, standard economic methods for determining value are not appropriate, either for the university as a whole or for its parts. It is almost impossible to be specific in answering the question: *How much does the library benefit the university?* As desirable as it may be, we believe that the answers cannot be approached on the institutional level, with any degree of specificity.

However, we believe that the issue of value-in-use can be productively explored on the *individual level.* Then an extension to the institutional context may be attempted. Thus, our basic decision is to concentrate solely on the perspective of individuals. In particular, we believe that the most effective approach to assessing the value of library and information services, as taken in this study, is to:

- focus the attention on the specific tasks or reasons that brought the user to the service;
- ask questions about the value in the specific context of that use; and
- express value in the language of the users.

6. Value of Information Services

We discussed the value of information and presented an *Acquisition-Cognition-Application* (A-C-A) model of information use in Section 3. We made a point that use and value of information differs from use and value of information services. Here we are elaborating on the differences and relations.

In this section we present another model called *Reasons-Interaction-Results* (R-I-R) model that represents use of information services. The elements in that model reflect the facets used in establishing value of information services. The R-I-R model is derived from and related to the A-C-A model, but it reflects a differing domain, specifically involving aspects of a service, which the A-C-A model does not. R-I-R is a specific model of use of information services that we have developed for a pragmatic study of user-assessed value (or value-in-use) and for the development of a *Derived Taxonomy of Value in Using Library and Information Services* as presented in Part II of this report. We derive the assumptions and premises for the R-I-R model from the concepts incorporated in the A-C-A model and, moreover, from an analysis of the process of use of library and information services by users.

6.1 Process of Use

To decompose the involved relations into components serving as the base for development of the R-I-R model, we use the following three premises reflecting the process:

(1) Users *interact* with a library and information service, that is, use or attempt to use a service, for some *reason(s)*. During the interaction the reason(s) may be altered or changed, but there are reasons at all times.
(2) As a result of the interaction, users obtain responses or *results,* be they positive or negative.
(3) Users *evaluate or assess* the interaction and the responses or results in relation to their reason(s) for using the library service(s).

In assessment of value, the reasons and interactions may be considered as a cause and results or responses as an effect. When examined in more detail, however, all of these are complex constructs and involve several distinct conceptual components, dimensions or facets. Thus, we adopt a faceted approach to developing of a taxonomy of value-in-use.

In seeking and using a service, a user engages in interaction with a library or information service. Traditionally, the interaction has been on-site, involving a physical proximity to the service. With the advent of information and communication technologies and networks, there is a significant increase in off-site interaction. We cannot measure value simply by the use of books and other materials in on-site visits. Thus, we have included both on-site and off-site interactions.

6.2 Definitions

Now we are ready to propose definitions. We start with a general definition of value related to the study of services as considered here. While the types of value as elucidated in philosophy (*intrinsic, instrumental, inherent,* and *contributory*) are not incompatible with the types in economics (*in-exchange* and *in-use*), for pragmatic reasons, we prefer to deal with the value of information services in terms of *in-exchange* and *in-use,* rather than in terms of the types proposed in philosophy. We start with the observation already made, that inevitably values are considered in some context and limited to that context. In both value types (exchange and use), the context in which value is considered is paramount.

We take it that *value within some context describes a relation between an object or objects* (be they tangible like products or intangible like ideas and information) and *their worth, which may include their merit, benefit, impact, quality, utility/usefulness, desirability, and/or cost.* The *cost* may not be necessarily monetary in nature, it could be represented by time or effort. As in philosophy, we treat ''worth'' as a primitive term. Thus, as a starting

point on a general level, we suggest that *value represents a relation between given object(s) and their worth in-exchange or in-use within some context.*

Based on the general definition and the analysis just summarized, we can now offer a specific definition used in this study that relates to value-in-use. We propose that *the value of a library and information service is an assessment by users (or user surrogates) of the qualities of an interaction with the service and the worth or benefits of the results of interaction, as related to the reasons for using the service.* A value assessment establishes a relation between the user's task on the one hand and the quality of interaction and the worth of obtained results, on the other hand. The context are the individual users and their given reasons or tasks that prompted them to seek a service.

6.3 Rationale for the Model

Integrating the concepts presented in this section and in the A-C-A model, we turn now to building a model that can be used for developing the Taxonomy. Our goal is to describe through the application of the Taxonomy the value of a service to the users that use them and through that to the institution(s) which support them. Since there is no internal market for this use, the value of information service cannot be based on exchange, but must be based, as already mentioned, on the concept of value-in-use. In other words, when a user gets information from a library in its own institution, such as an academic user using its own university library, the user does not exchange that information for something of value. Rather the user uses that information.

With respect to value as classified in philosophy (Section 2.1), we think of ''being informed'' as having intrinsic value for a user, and thus information as having extrinsic or instrumental value, objects potentially conveying information as having inherent value, and an information service as having contributory value.

With respect to approaches to study of value (section 3.2), we adopt the perceived value approach as the basis for the development of the R-I-R model and the Taxonomy. In other words, we base our Taxonomy on the users' perceptions of the information they obtain, and the interaction they engage in with the service, in relation to intrinsic goals (e.g., ''being informed'') and/or its instrumentality in resolution of problems or accomplishment of tasks.

We shall find, however, that for users, the conceptual dimensions of value related to information services are intertwined with their perception of the process of *Acquisition.* Thus, while a model of value of information could focus on cognitive and application aspects, a model of value of information services must include the users' perceptions of the processes involved in acquiring the information from a service. We shall find in addition, that the users' account of use of a library and information service puts the cart first and identifies the intended application as a reason for use.

To account for this, we develop a separate R-I-R model of use of information services, derived from the A-I-C model, and related to it as explained in the above paragraph. The R-I-R model reflects the facets of value in use of information services.

Through these models, we now have answers how to approach the fundamental questions: What relations and dimensions to concentrate on, in what contexts, and who is to assess the relation? In other words: What establishes value of library and information services, theoretically and pragmatically, to satisfy different contexts?

6.4 The Reasons-Interaction-Results Model

We suggest a model of *use of information service* that we call *Reasons-Interaction-Results* or R-I-R model. This model involves three broad dimensions or facets reflecting the value-in-use of a service:

(1) *Reasons* for use of the library or information service on this occasion. Provides the necessary context for assessing other dimensions or facets. Covers the causes, motives, bases, purposes, expectations, and/or rationale underlying the use of a library or information service. Why do users use a service? What do they want to get out of a service? The *Reasons* may be defined in various degrees from ''ill'' to ''well,'' but nevertheless intentionality is always present.

(2) Associated qualities of *interaction* with a service while using it for given reason(s). Covers the assessment of users of the qualities, problems, and convenience of various aspects of a service. How does a user asses the encounters with the library or information system in seeking and obtaining a service?

(3) Subsequent *results* from the interaction or use and their worth or benefits. Covers the users' assessment of outcomes. What did a user get out of the service? What did a user accomplish? To what degree were the expectations met? How relevant were the results? How useful? How were the results related to time and/or money expanded?

Translating these facets into the framework of other approaches where user-assessed value plays a critical role (e.g., Total Quality Management—TQM), interaction may be considered the ''service,'' and results the ''product'' of interaction. As in other situations, and particularly as stressed by TQM, the value to the user *(value-in-use) is a composite of both the quality of the service and the worth or benefits of the results in relation to some context or reason.*

We structure the Taxonomy presented in Part II along the three main facets in the R-I-R model. In addition, we

further resolve (subdivide) these three general facets or dimensions into subfacets or subclasses and each of these into specific categories. These subdivisions are an elaboration of the model, specific to the research libraries which we studied. Together, they represent dimensions of value in using library and information services.

7. Conclusions

We report in two parts on a large, pragmatic study of value of library and information services. In this first part, we undertook an analysis of the major issues related to study of value of library and information services and developed a conceptual structure and models that serve as a (Saracevic-Kantor or S-K) *theory of use-oriented value of information and information services.* The theory serves as a framework that is necessary to derive the Taxonomy reported in Part II, and to study value of such services in general. To review the major points of our analysis:

- It is important to study value of library and information services in more specific terms than ever before because such services are in transition and face increased competition. Funders would like more specific justification of expenses in terms of value.
- In philosophy, value is dealt in terms of *intrinsic, extrinsic/instrumental, inherent*, and *contributory* value. These types apply to information and information services. However, it is more useful for purposes of justification, to concentrate on *value-in-exchange* and *value-in-use* as treated in economics.
- Value-of-exchange studies involving either information in a broader sense or information services have not been particularly successful. Value-in-use studies, borrowing from economic concepts seem more appropriate. Utility, reflecting value-in-use, of information services can be appraised from users assessments of value.
- Relevance is considered as a criterion reflecting the effectiveness of exchange of information between people, i.e., users, and information systems in a communication contact, based on valuation by people. Relevance reflects some, but not all dimensions of value. However, in order to be of value information or information objects have to be relevant first.
- Value is and must be considered in some context. In relation to information and information services the context of use is highly important.
- Value of information and value of information services differ. One can attempt to asses value of information services without directly valuing information itself. However, we need two models: one to reflect use of information and the other to the use of information services in order to asses value of each. While the two models are related, they also address differing aspects.
- A model reflecting the use of information decomposes the cycle of use into *Acquisition, Cognition,* and *Application.* This is the basic model used in the study.
- A further and related model is developed that reflects the use of information services and incorporates elements of *Reasons, Interaction,* and *Results.* These two models serve as the base for developing the approach in our study and for distinguishing facets of value. They suggested the questions asked of users and the faceted development of the Taxonomy.
- We take it that the value of library and information services is an assessment by users (or user surrogates) about the qualities of interaction with the service, and the worth or benefits of the results of interaction, as related to the reasons for using the services.

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