Sixty years of measuring the use of information and its sources: from consultation to application

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Abstract
The historical development of use and user studies is characterized as divided into three “eras”: that of the Collection, the Document, and the Chunk. Typical concerns of each era are discussed. It is suggested that underlying the changes in measures was also a quest for measuring “genuine use” of information, that being the ultimate ends to which information found by users was put—what has been variously called the application, outcome, consequence or effects of information. Central to this has been a greater sophistication in methodology, including an increasing reliance on qualitative techniques to achieve greater depth. Results are presented from a recent content analysis of samples of 62 years of information behavior studies, showing a recent growth in measures of information outcomes. Suggestions are made about the further evolution of evidence in the light of the development of new types of measurements, such as those made possible by social media, and the limitations of such data are discussed.

Keywords: outcomes, applications, effects, measures

Introduction
This paper has a historical theme, examining how definitions and research methods have changed, particularly in regards to measuring the outcomes of information use. I begin with some of the earliest attempts to measure use of library collections, and discuss how they have changed over time. Then I touch upon recent investigations that achieve a better measure of some important aspects of information use, namely the applications or outcomes of information by the user. And, to provide continuity between the two themes of the conference, social media is discussed as a current source of data on use and sharing of information.

The measurement of the use of libraries and other channels of information has seen various phases as regards sources of data and objects of study. These phases could be condensed into three periods: the era of the collection, the era of the document, and finally, the era of the “chunk”—the latter being some kind of fact or other selection of information that is smaller than an entire document. Each era built on the methods and data of the one before it, such that earlier types of research never completely disappeared.

After describing the different phases of methods and data, I return to the issue of what we mean by “use,” whether of libraries, or of information in general. I argue that throughout almost all of these periods, investigators sometimes tried to measure a more restricted sense of use, that is, as what people do with received information, how they apply it or what effect it has on them. These attempts to measure information have gradually increased in frequency, from being quite rare 40 years ago, to fairly commonplace today. Measurement of what we could call “outcomes” has required advances in both qualitative and quantitative methods, yet owes more to an effort to increase depth of measurement in general.

The History of Studying Needs, Seeking and Use
In my book, “Looking for Information” (Case, 2012), I say that research on information needs, seeking and use goes back about a century. I could also make the case that a century ago (say, 1914), is either 65 years too late, or 20 years too early, as a starting date for this genre of research. For example, there is an 1849 report to the British Parliament (see Wellard, 1935) that attempts to describe the effects of libraries and reading among English working class in various towns, based on expert testimony. While lacking the consistency and rigor that we would today require of a scholarly study, it is an early example of an attempt to answer the question “what effects do public libraries actually have on the populations they serve?” Yet, as the 1849 report was not a scientific investigation. And even later studies sometimes heralded as the start of serious investigation, such as Charles Eliot’s (1902) study of unused library collections, or Ayres and McKinnie’s (1916) investigations of children’s reading habits, appear to have rather different aims than modern studies, and also to be very superficial in their analyses of data.

In my judgment, serious research on information seeking and use began in the late 1930s, when a few investigators began to more look in depth at what people did with documents—a kind of investigation that did not really
become common until the 1990s. The division of information behavior studies into three eras, is a simplification that ignores outlying efforts in both directions; i.e., it underemphasizes the early pioneers of more sophisticated methods, as well as those who continue to conduct rather simplistic study designs well past the time they should be used. Yet I think it serves to highlight important shifts in focus over the years.

To foreshadow what is to come, I will summarize the three eras in one sentence, each: The first era studied library collections, particularly what was being circulated, and by whom. The second focused on documents, and could also be called the period of reading research (e.g., see Ward, 1977). Finally, the third and present era is that of the chunk, in which attention turned to units of information smaller than documents, and not always originating from a document either, but also from conversation, mass media, and eventually the Web and social media.

**The Era of the Library Collection, 1836-1935**

In the beginning, there were circulation records. This single indicator was easy to count, and indeed necessary for the internal administration of the library. As Williams (1991) and Galbi (2007) point out, public library circulation measures were published in the United States at least as far back as 1836. Several other nations, Great Britain, for example, also kept borrowing statistics in the 19th century (Kelly, 1966). Circulation measures were typically broken down by aspects of the user population, time periods and collections, to produce percentages and ratios, such as yearly circulation per capita or by gender and age categories. When used in conjunction with such demographic data, Burns (1978, p. 8) says circulation measures were “the richest source by far of information about the user, items used and use patterns . . . the easiest to gather, and the best available performance measures.”

Accordingly, circulation statistics and demographics formed the basis for most investigations of patrons interactions with collections. A late example from this era is McDiarmid’s (1935) study of patterns of borrowing in a university library, in which gender and class standing were used to breakdown the numbers and types of books, magazines and newspapers read, based on circulation records and a survey of borrowers. During this period yet other studies approached preferences for books via survey questions, such as those reported in Waples and Tyler’s (1931), “What people want to read about”; the superficiality of such findings was sometimes subject to criticism (e.g., Mencken, 1931).

In many respects the era of the collection has never really ended, as can be seen from complex studies of collection usage that took place later in the 20th century (e.g., Fussler & Simon, 1969; Kent, Cohen, et al., 1979). On top of basic circulation data grew a host of other evaluation measures of library facilities and their collections, as the emphasis shifted from what the library does, to what the patron does (Ford, 1977; White, 1980; Zweizig, 1977). Among other patron actions, these included in-house (i.e., non-circulating) consultation of materials, questions asked at reference desks, use of card catalogs (Tagliacozzo & Kochen, 1970) and much later, electronic catalogues and databases. To these measures were added data from surveys of users (what Burns, 1978, calls “preferential data”) regarding satisfaction with services, preferences for materials and hours, awareness of services, reasons for nonuse of the library, and so forth (Lancaster, 1977; Powell, 1988). In summary, the key feature of this era is that the library collection, services and building formed the starting point for the investigations, rather than any particular people or units of information outside of the collection.

**The Era of the Document, 1936-1958**

I choose 1936 as a starting point because this was the year in which a few pioneering studies examined the outcomes of document use, rather than simple indicators of the consultation of library collections. In that year two Masters theses in Education at George Peabody College in the U.S. considered the effects of reading. One (Gross, 1936) examined the responses made by seven-year-old children to books they read, using a mix of observations, interviews and borrowing records. The other (Clements, 1936) studied how 11-year-old children made use of magazines, based on interviews and borrowing records. Both studies were concerned with what school libraries could do to promote reading, and both theses were identified in *Library Quarterly* (Waples, 1939) as research in librarianship. While the evidence Gross and Clements collected was modest, each recorded some instances in which a direct effect of reading was observed or reported, e.g., in Gross’s study whether a child used the book to copy words or pictures, or whether they shared the book with another child; in Clement’s investigation children were observed reading to others the jokes, riddles, poems or stories they liked in a magazine, or used elements of magazine pictures to improve their drawings.

Probably similar studies were undertaken at other universities and in other nations, and some may even predate the two theses I described above. Yet what is interesting about the two Peabody investigations was their incorporation of qualitative methods, such as observation and open-ended interviews. As one evaluation researcher simply puts it, “qualitative data provide depth and detail” (Patton, 1980, p. 22), and afford understanding of phenomena that cannot always be categorized in advance.

However, more typical of this era were studies of reading preferences and habits that did not attempt to assess the results of something being read (e.g., Hansford, 1936; Stuart, 1952; Thorne, 1954). Martin Ward’s (1977) book, “Readers and library users,” summarizes many reading habit surveys among the 126 studies it reviews, 35 (28%) of those investigations taking place from the 1930s through the
1950s. These were typically investigations of what books readers preferred or borrowed or bought, broken out by user demographics—a genre of research that stretches into the present day. Rarely did the conclusions of these studies venture beyond preferences by gender, age, geography or occupation, and the synopsis of key findings sometimes verges on the anecdotal, e.g., “Engineers were the most active readers” (Ward, 1977, p. 45) and “The most books were read by a lorry driver” (p. 31).

In the United States attention was sometimes paid to narrower categories of readers, such as McNeal’s (1951) study of the reading interests of rural people, and wider geographical regions, like Campbell and Metzner’s (1950) nation-wide sample of United States public library users in 1947; these contrast sharply with the many local British studies from the 1940s and 1950s cited in Ward’s (1977) annotated bibliography.

An important turning point is the series of investigations in the 1940s by Bernard Berelson (1949), Robert Leigh (1950) and other researchers at the University of Chicago, which raised important questions about why people use libraries. The advance in these studies lay in going beyond mere counts of items borrowed, analyzed by subject categories or types of borrower. They also improved on other popular research goals, such as identifying the unused parts of the collection, crosstabulating the demographic characteristics of those with library cards, or asking users questions about their needs, attitudes or awareness regarding books and libraries. What this new wave of investigations did was to dig deeper into such issues as why someone used the library (or another information channel or source), and what effects it had on them as a result. A parallel development lay in investigations of what people did in their own creative works, such as Swank’s (1945) study of sources used in doctoral theses.

The Era of the Chunk, 1959-Present

The next era reflects two related developments: a shift away from focusing on single channels like libraries, and an accompanying interest in “smaller” units of information—e.g., answers to questions. Gradually investigations also moved beyond single channels (e.g., books, radio, or conversation), to consider multiple channels from among which an individual made active choices in pursuit of particular information. An early example of multiple channel research is found in Westley and Barrow’s (1959) investigation of student use of magazine, newspapers, radio and television for news — among the first outside of university studies to describe “information seeking” by “information seekers.” Westley and Barrow shifted their focus away from the usual concern with attitude change, and towards the need for facts about the world in which one lives—“orienting information,” as they characterized it. Investigations of scientists and engineers during the 1960s and 1970s also took this approach; for example, Wood (1971) cites Thomas Allen’s (1965; Allen & Gerstberger, 1967) “multi-channel” investigations as especially “successful.” In each case, recording of specific facts learned from particular sources (a colleague, an article, or radio/TV broadcast) pointed towards another innovation in information seeking research: the chunk.

The second important development was in the increasing focus on some unit of information smaller than a document. Paisley (1965, p. II-49) discusses this idea as introduced in a study of 1375 scientists and engineers by the Auerbach Corporation (1965). In these interviews a “chunk of information” was defined as “the smallest quantity of information required to answer a task-related question.” This term was adopted by Taylor (1986, p.11), who described “insertion of a chunk of information in a report.” It is possible that all of these authors were influenced by George Miller’s discussion of “chunking” of information in his famous essay on memory limits, “the magical number seven” (1956). Other variants of the chunk concept used terms like “ideas” or “solutions” (Allen, 1965), or “notes” or “conversations” (American Psychological Association, 1967, 1968) to characterize a unit of analysis that was less than an entire document.

The interest in answers to specific questions, as sought from multiple sources, was later extended to non-work information needs, such as the information required to address a personal problem or satisfy one’s curiosity—the kind of activities described in Savolainen’s (1995) Everyday Life Information Seeking (ELIS) model.

The Frontier: Measuring Outcomes

Thus far I have described the development of information seeking research in terms of what kinds of data were collected. Yet there is another, underlying, change in measurement: a gradual progression towards investigations of what have been called “outcomes” of information. To describe what is meant by “outcomes” will again require some historical background.

One of the curiosities of this genre of research is that we have tended to leave some terms rather ambiguous, even while continuing to investigate them in their various forms. One example is the concept of “information” itself, while another is “use.” These terms have had varying definitions among scholars, and even more so among laypeople. Kidston (1985), for example, demonstrated wide differences among a sample of students as to whether the term “use” could apply to such concrete examples as reading a journal from cover to cover, or reading only one section of a book. Ercegovic, (1997) also finds confusion among students regarding the concept of “use.”

The more pertinent issue, however, is how use of information has been studied. A number of scholars (among them Brittain, 1970; Fidel, 2012; Kari, 2007; Savolainen, 2009; Taylor, 1986; Todd, 1999; and Vakkari, 1997, 1999, 2008) have noted that nearly all investigations have measured needs, demands, seeking and/or gathering, while
relatively few examined how retrieved information is actually applied—what Taylor (1986) refers to as “effects” of information, Paisley (1968) “consequences,” Rich (1997) “impacts,” and Kari (2007) “outcomes.” Brittain (1970, p. 1) may have summed it up best (as well as first) when he wrote that “ambiguity resides in the term ‘use’ . . . [which typically] refers to the study of the gathering stage of use rather than the use of which information is put.”

Whether we called the more restricted meaning of use “effects” or “outcomes,” it is clear that it has not been commonly studied. Fidel (2012) judges that “only a few” such studies have been attempted, while Vakkari (1997) similarly describes the incidence as “rare.” Undoubtedly his comment was informed by his earlier content analysis of information science literature (Järvelin & Vakkari’s, 1993), which estimated the proportion of articles addressing various topics during three decades apart. Even combining their two categories “information use” and “use/users of information channels/sources” shows that only about two percent of research articles addressed either of those topics: 2.1% in 1965, 1.7% in 1975 and 2.2% in 1985. And those categories are more inclusive than what the present study counted as an “outcome.” Certainly before 1986 investigations of outcomes were “rare,” although since 1995 they have become more common.

To estimate just how rare has been the measurement of information effects or outcomes, Case and O'Connor (2014) recently conducted an analysis of measures of “information use,” in the more restricted senses discussed above—as how a user applies information, or an effect that information has on a person. By choosing the earliest dates that would allow multiple LIS journals to be sampled together, and interpolating additional dates at regular intervals, the years 1950, 1964, 1979, 1995 and 2011 were chosen as starting points for sampling, with such roughly 13 years (12 to 14 years) passed between each sample. In each of the five periods except the final, three calendar years were sampled. Using these criteria, American Documentation (the earlier title of JASIS) and the Journal of Documentation were sampled during the first two periods; Library & Information Science Research was added to these for the third period; and Information Research was included in the fourth and fifth samples. All four journals were earlier determined to be those most likely to include information seeking research, based on a content analysis of two large bibliographies on information seeking.

**Method of Sampling and Analysis**

Editorials, editorial introductions, book reviews, obituaries, news reports, bibliographies, brief communications and letters were excluded from analysis; only articles longer than 2 pages in length were considered for examination. After these criteria were satisfied, it was determined whether or not the eligible articles constituted a “study,” which was defined as an empirical investigation of some phenomenon, of a method either qualitative or quantitative, in which observations were taken, then analyzed and/or interpreted; observations could be expressed in the form of numbers, or as a narrative. Literature reviews, conceptual essays, simple descriptions (e.g., of libraries, library collections, classification schemes, indexing languages, devices or computer programs), or articles solely about concepts or theories or models, were not counted as investigations. For each journal issue we counted the number of such observation-based studies published in each issue.

Then we recorded the number of empirical studies that could be classified as being a part of the Human Information Behavior (HIB) or “information needs, seeking and uses” research tradition—keeping in mind that the journals sampled publish a wide variety of topics. Taking definitions such as that found in Bates (2010) as a guide, HIB was taken to include studies of phenomena like these (starting with the more general): information needs, information seeking, information gathering, use of or preferences for channels and sources, sharing of information, passive encountering or awareness of information, ignoring or rejection of information, creation of new documents or other objects, utilization of information for a task or for pleasure, browsing, use of libraries, use of documents, searching of indexes and catalogs, searching of databases or websites, information literacy, and studies of reading. We excluded articles that fell into related yet distinct areas, such as the evaluation of information retrieval systems, information system design, systems of classification or indexing, or bibliographic and webmetrics studies.

Next we recorded the number of studies that included measures of information use in the way described below. In a close reading of study results, the text was examined for instances in which investigators tried to measure information use in ways that went beyond mere searching of systems or channels, or of retrieval of documents. We looked for reported outcomes, i.e., application to a task, making of a decision, or effects based on the information received, such as evidence of learning, or deriving some kind of psychological or emotional benefit. An example of a specific outcome would be a respondent who said “After reading the Merek manual I decided to change my medication.” Instances of projected use were excluded, as when a respondent merely says how they intend to apply information they have received. Hypothetical situations were also excluded, e.g., an experiment based on imposed decisions using hypothetical data and chances.

Without going into details of results by time period or journal, the overall picture is that about 6.1% of all investigations (all of these published within the last 19 years) across the four journals contained measures of outcomes. Vakkari’s (1997) comment that such studies are “rare” was written 17 years ago, at a time when measures of the ultimate application of information were just starting to become more common. Looking back from 1997, it would have been fair
to say that such investigations were “rare.” Overall it is still
quite remarkable that investigators in information science so
seldom measure the outcomes of seeking and encountering
— whether the percentage of studies that do so is six percent
or even ten percent.

Table 1. Numbers of Outcome Measures in 5 Samples,

<table>
<thead>
<tr>
<th>Years of Samples</th>
<th>Number of Full Articles</th>
<th>Number of Empirical Studies</th>
<th>No. &amp; % Measuring Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-1952</td>
<td>124</td>
<td>16</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>1964-1966</td>
<td>146</td>
<td>43</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>1979-1981</td>
<td>214</td>
<td>139</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>1995-1997</td>
<td>338</td>
<td>218</td>
<td>15 (6.9%)</td>
</tr>
<tr>
<td>2011-2012</td>
<td>569</td>
<td>499</td>
<td>41 (8.2%)</td>
</tr>
<tr>
<td>TOTALS</td>
<td>1,391</td>
<td>915</td>
<td>56 (6.1%)</td>
</tr>
</tbody>
</table>

In considering the evolution of outcome measures we
should keep in mind that early researchers were well aware
that the utilization and effects of information were
important. Sixty-five years ago Bernal (1948) surveyed
workers in a variety of universities and research laboratories
about what they did with papers they received; however, the
cfive response choices were limited to “read carefully once,
read carefully more than once,” and the like. In those early
days the concern of information needs and uses researchers
were much more about earlier stages in the communication
chain, especially what authors, publishers, conferences and
libraries could do to improve the dissemination of research
publications. What the intended audience did with this
information was a more distant concern.

Bernal’s method points to an obvious problem: it is not
easy to study the ultimate outcomes of information. It is
harder to study the outcomes of information receipt than
searching of, or preferences for, channels and sources. Dunn
(1983) and Rich (1997) explain the many ways in which
information use might be defined, and why it is often
difficult to measure. Rich (p. 15-16) notes that we may have
initial difficulties in determining exactly what qualifies as
“information”; beyond that, there are a series of relevant
stages: acquiring or receipt, which does not imply reading:
reading, which does not guarantee understanding;
understanding, which does not imply further action on that
basis; and, finally, an influence, action or other impact. And
even in this final stage, the notion of “influence” (meaning
“contributed to a decision, an action, or to a way of thinking
about a problem”) suggests delays in effects that may render
the connection between receipt and effect unobservable or
otherwise invisible.

There are simply few reliable and ethical methods for
observing or recording thoughts, decisions, and applications
of information. In many cases it is impossible. We know that
self-reports are biased, yet often they are our only option. As
discussed by Davenport (2010), one potential approach for
eliciting respondent accounts is the critical incident
technique, and another is sensemaking (e.g., Dervin, 1992).
Using either method an investigator may inquire about the
outcomes and aftermath of finding or encountering
information. Yet both techniques have been plagued by
misuse, as some researchers take shortcuts around checks on
reliability (Davenport, 2010). Similarly other qualitative
methods are sometimes poorly executed (Sandstrom &
Sandstrom, 1999). Clearly, measuring the outcomes of
information is challenging, and that may be why many
researchers have not attempted to do so.

Conclusions

One of the reasons that there has been a growth in
measures of outcomes of information is precisely because of
greater applications of qualitative methods. As Tom Wilson
pointed out over 30 years ago (1981) qualitative methods are
better suited than questionnaire-based surveys for
understanding needs, seeking and use. First-person accounts
of interactions with information sometimes contain evidence
of applications that would otherwise have been missed in
simple surveys regarding consultation of channels or
sources. A recent example is David Allen’s (2011) study that
observed police officers deciding whether or not to stop cars
for traffic violations, recording the kinds of observations,
conversations and information searches that led to a
decision.

Yet quantitative measures have not gone away, as can be
seen from studies like that of Grad, Pluye et al. (2011), who
used hand-held computers to investigate the use and effects
of information by family physicians. Their largely statistical
results capture yes-no responses to cognitive impact
statements like “I learned something new” or “I was
reassured.” The Grad study points to the ease with which the
Internet can be used to capture information at point and time
of use. As information seeking and sharing becomes ever
more electronic via Internet resources and mobile
communications, we will have more opportunities to capture
outcomes. Imagine, for example, someone who forwards an
email or text message or tweet — they have judged the
content interesting and passed it on—a recorded instance of
sharing information. Electronic information that is both
retrieved and applied (e.g., incorporated into new electronic
documents or messages) offers an opportunity to capture
such use. But of course this too, is sometimes impossible,
due to legal and ethical restrictions on the privacy of
individuals.

Social media offers us vast amounts of data generated by
users in the course of their daily lives and work. Any new
data is welcome, and especially when it is not solicited by
researchers but rather naturally-occurring—which reduces
the bias problems that arise when we ask people questions.
Yet, we need to be cautious about what we glean from social media. In some ways it is like the book circulation data I discussed at the start of this paper: we analyze it because it is there. In that sense it is like the Law of the Hammer—a tool that must be used simply because it exists. A better analogy is the drunk outside the bar late at night, searching for his lost keys under the streetlight, where “the light is better,” rather than in the shadows, where he dropped them. (This analogy is used to great effect by Gary Klein in his 2009 book Streetlights and shadows, to discuss common errors in decision-making.) The new data, however innovative, can only tell us so much; it is valid for certain purposes only; it does not replace other data; it has its own biases. We must not let the latest source of data distract us from our original goals and questions—which may require more difficult searching in the “shadows.”

Earlier I mentioned the problem of reactivity. The very social nature of social media means that it can be especially reactive when we intervene in it. An example is the creation of Facebook pages by some academic libraries, in order to connect with students. The very fact that libraries create Facebook pages makes Facebook less “cool” in the eyes of many young people. They see the value of Facebook for interacting with friends, but not necessarily with institutions. By trying to make use of a trend, we change it.

For these and other reasons, I don’t expect social media to answer many questions about the outcomes of information, although it will be helpful in identifying other answers about the use and value of information. Most social media data reflect only the receipt or sharing of electronic information, and not consultation of other channels and sources, nor does it always indicate some kind of outcome. For that we need additional methods or measures. Quantitative measures will answer some questions, but for the more difficult questions, such as establishing the application or effects of information, qualitative methods remain necessary for finding answers. Through measuring the outcomes of information, we can establish the value of the channels, such as libraries, that led to the discovery of the information in the first place.

It could be that progress is only an illusion, however I believe I see some progress in the sophistication of methods applied to information seeking and use. At the same time, there have been technological advances that continue to challenge measurement. We must always look for new ways of, and opportunities for, conceptualizing and measuring the use of information.

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**Curriculum Vitae**

Donald O. Case holds the PhD in Communication Research from Stanford University (1984) and the MLS from Syracuse University (1977). He has been a Professor in the University of Kentucky College of Communication & Information since 1994, and taught at the University of California, Los Angeles, from 1983 to 1994.

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