

INSTITUTE FOR SCIENTIFIC INFORMATION

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The Institute for Scientific Information (ISI), a multinational corporation that provides a wide variety of information services to scientists throughout the world, is an unusual mix of scientific academia and commercial business.

Its services reflect the information scientist's concern with bibliographic subtleties and innovative methodology. One of its three major groups of services is led by *Current Contents*, a series of weekly announcement journals that use the elegantly simple mechanism of reproducing contents pages to keep scientists informed about what is being published in the journal literature. Another group of services is built upon *Science Citation Index*, which uses a relatively new and unconventional indexing technique to pursue ideas across disciplinary boundaries and beyond the semantic limitations of traditional subject indexes. A third group of services offers a new type of index that permits the chemical journal literature to be searched, either manually or by computer, by chemical substructures—a significant improvement in search specificity. In terms of its services, ISI is very much an information scientist's information company.

In terms of its operating philosophy, however, ISI is very much a businessman's business. Operating in a field that traditionally has been dominated by the nonprofit organizations of government agencies and professional societies, ISI from the beginning has been unabashedly and successfully commercial. It is a for-profit corporation, with a history of plowing its profits back into new and improved services that will expand and consolidate its markets. It markets its services aggressively, eschewing the nonprofit approach of waiting for the world to beat a path to its better mousetraps in favor of actively searching out and selling customers. And its sophistication in the information sciences is kept carefully subjugated to the needs of the marketplace. The danger of developing services that are professionally intriguing to the information scientist, but only marginally useful to the people who are supposed to use them, is avoided by a deep understanding of the work habits and information requirements of scientists in many disciplines and at many levels of research.

Origins

The special character of ISI reflects the response of one man to the special conditions that prevailed in the field of scientific/technical documentation after World War II. The man is Dr. Eugene Garfield, founder and current president of ISI.

Garfield wandered into the field by accident in 1951. A new bachelor of science with a degree in chemistry, he attended, out of curiosity, a session on documentation at the Diamond Jubilee meeting of the American Chemical Society. A casual meeting with the chairman of the session, James W. Perry, led to a position as a research assistant on an Army Medical Library project at Johns Hopkins (1) that was looking into the development of machine-based indexes to the medical literature.

Although he didn't know it at the time, Garfield had entered a field that was rapidly approaching the critical mass that precedes explosive development. The pace of scientific research and development was accelerating. The volume of scientific/technical information being published was increasing, as was the demand for the information, and the nature of the demand was changing. The state of the art was advancing rapidly in many disciplines, and boundaries between disciplines were becoming blurred. The demand for information was beginning to place more and more value on the speed with which pertinent, published material could be obtained, and the ability to cross disciplinary lines in the search for such material. At the same time all this was happening, the electronic, digital computer was focusing attention on the possibilities of developing machine methods for handling information.

Under the pressure of all of these changes, the information field was getting ready to set forth on a long road of development that is still continuing.

Garfield started the journey at the very beginning. The Johns Hopkins project was the first major investigation into the potential of machine-based information systems, the watershed of much of the development that has since followed. As such, the project made him a member of a small group that has dominated the field of library and information sciences during its past 2 decades of change.

Technological Foundation

The technological foundation for ISI was laid while Garfield was with the Johns Hopkins project. During the 2 years he spent there, he not only developed a general interest and expertise in indexing methodology (2, 3), but also gained a very special insight into the subject. In reading review articles of fields he would be indexing, Garfield realized that nearly every statement made in such an article was supported by a reference to a previous piece of literature, and that the bibliography of each of these articles was really a series of indexing statements. By the time he finished at Johns Hopkins, he was corresponding with William C. Adair, a former vice president of the company that published *Shepard's Citations*, a legal reference tool, and had come to the conclusion that citations referenced in scientific material could be used to provide a new and valuable way of indexing the scientific literature (4).

Another important thing that Garfield did before leaving Johns Hopkins was to begin producing a contents-page announcement service for the journal literature of information and library sciences. The initial motivation for this service, titled *Contents In Advance* (5), was personal. As a researcher, he felt a strong need for some sort of formal mechanism to keep him up to date on what was being published in his field of study. Before long, however, a small demand built up for *Contents In Advance*, and he decided to continue publishing it after he left the project to take a Master's degree in Library Sciences at Columbia.

Random Evolution

Though the two concepts of citation indexing and a contents-page announcement service were to provide the technological foundation for ISI, Garfield had no intention of building an organizational structure on them at the time he went to Columbia. He was inclined toward an academic career. ISI and the business career associated with it were to evolve from a series of random events and professional frustrations over the next few years.

The first of these events was the offer, after Columbia, of a consulting assignment from Smith, Kline & French to work on machine-based indexes to the pharmaceutical literature.

The second event came soon after, in the form of a contract from Bell Telephone Laboratories to produce a contents-page service for the laboratory staff on the journal literature of management. Bell Laboratories had been running such a service themselves. Garfield, still intrigued by his experience with *Contents In Advance*, obtained a contract to do it for them. The contract also gave him the right to market the service commercially under a different name. For Bell, the service was called *Survey of Current Management Literature*. Outside, it was sold as *Management's Documentation Preview*. Garfield set up a company called Documentation Inc. to produce and sell the service.

Although the Bell Laboratories contract lasted for 8 years, outside sales of the service were much too meager to generate any visions of commercial success. Acting on professional marketing advice, he changed the name of the company to Eugene Garfield Associates and the name of the service to *Current Contents*, but continued in the direction of an academic career by starting work at the University of Pennsylvania on a Ph.D. in structural linguistics. The direction, however, was due to change over the next few years.

The stage was set for the change soon after Garfield started his Ph.D. work (6). He was asked by the librarian of one of the pharmaceutical companies to produce a contents-page service for the medical and pharmaceutical literature. This request led to the development of *Current Contents/Life Sciences*, which was to become the most heavily used current-awareness service in the scientific world. Though it was not an instant success, the demand for this service grew steadily, first among the pharmaceutical companies, and then among life scientists working in other research areas.

The introduction of *Current Contents/Life Sciences* marked two milestones in the evolution of ISI. It brought Garfield's commercial activities to a level that required him to hire another professional—the first step in building an organization. It also provided a business base that would become strong enough for him to afford to take some commercial risks on advanced ideas that would be rejected by the nonprofit organizations that dominated the field.

A Commercial Commitment

The first of these ideas was a computer-based molecular-formula index to the chemical literature that would announce and index material within a month after its primary publication. The idea grew out of a 3-year project Garfield had undertaken for the Pharmaceutical Manufacturers Association in 1957 to produce a

machine-based index to the patent literature on steroid compounds. Active in the American Chemical Society, whose *Chemical Abstracts* was the major chemical-information service, Garfield tried to persuade that organization to develop the type of index he had in mind. Unsuccessful, but convinced that a computer-based molecular-formula index would be a useful tool for chemists concerned with compound synthesis, he decided to assume the job himself.

In 1960 he introduced *Index Chemicus* (7), which eventually became the foundation for a broad line of chemical-information services. At the same time, the name of the organization was changed to the Institute for Scientific Information to provide a more institutional setting for the new service. These two actions added up to a commitment to build a commercial information-services organization.

The commitment was a conscious one, but it was not a very ambitious one. It included no plans for building ISI into a major company that would provide a full range of information services to the world's scientific and technical community. The formulation of that objective waited for the rejection of another idea.

The second rejection came in 1963 and involved citation indexing. Garfield had never lost his interest in the subject. While at Columbia, he wrote a paper describing how citation indexing could be applied to the scientific literature. He also maintained a correspondence on the subject with a number of interested scientists, including Professor Joshua Lederberg of Stanford University, who suggested applying for a government grant to produce a pilot index.

In 1961, ISI received such a grant from the National Institutes of Health, which later transferred the grant to the National Science Foundation. The grant called for the production of a citation index to the genetics literature, and recommendations on the feasibility, production methodology, and disciplinary scope of citation indexes to the scientific literature.

ISI's approach to the production of a citation index to genetics was to prepare a multidisciplinary index to the material published in 613 journals in 1961, and then to extract, according to bibliographic and other criteria, all the citations having to do with genetics. The approach was a response to the difficulty of defining, at the beginning, the boundaries of the genetics literature—a job the citation data made much easier.

ISI produced an index to the genetics literature of some 266,000 citations, and printed 1,000 copies of the index for distribution and evaluation. It also recommended that the entire data base of 1.4 million citations, from which the genetics index had been extracted, be published as a multidisciplinary index for evaluation by the scientific community. The recommendation was rejected.

Believing in the value of a multidisciplinary citation index, ISI then made two decisions. First, it decided to publish the multidisciplinary index itself. When it quickly obtained enough orders to cover the cost of that undertaking, it made a second decision—to produce a continuing, yearly citation index to all the scientific literature.

With the second decision, ISI made a commitment to try to establish itself as a major, international center for scientific and technical information. Garfield was convinced that the nonprofit organizations in the scientific/technical information field could not be responsive to the changing information requirements of the

community (8), because they lacked both a compelling reason for doing so and an objective way of determining what was and was not useful. In a commercial organization, he concluded, survival provided the reason, and sales provided the measurement of utility.

ISI Today

Today ISI is an organization of approximately 300 people, of whom fifty-two are degree-bearing professionals, that sells a mix of approximately twenty services from twelve offices around the world. Its international scope is demonstrated by the fact that close to 50% of its sales are outside the United States.

Its professional stature is demonstrated not only by the sophistication of its services, but also by the fact that it conducts some 300 information-science seminars a year for government, industrial, and academic groups; writes an average of twenty-five papers a year for publication in professional journals and presentation at professional meetings; and includes two Nobel laureates on its board of directors.

Commercially, ISI is the largest for-profit organization in the world specializing in secondary information services in the scientific/technical area. It has achieved this rank by increasing its revenues an average of 27.5% a year from 1965 through 1971.

In the process, the company has become a massive information center, in which comprehensive bibliographic descriptions, including indexes, of some 500,000 items a year, from every issue of 5,000 journals of all disciplines, and from all over the world, are generated and entered into a computer-based system that produces a torrent of material to the specifications of the ISI services. Indexing in this operation goes to an average depth of twenty-five primary descriptors, of which four different types are used. Production methodology is equally as sophisticated, with computer input operations built around key-to-disk technology (optical scanning is being studied) and outputs generated by computer-driven photo-composition equipment.

From the viewpoint of subscriber utility, ISI's three major groups of services provide a degree of bibliographic control—in terms of both current awareness and retrospective search—of the journal literature of science and technology that is probably unmatched by any other organization in the world.

The *Current Contents* group of services provides weekly contents-page coverage of six different disciplinary areas: life sciences; agricultural, biology, and environmental sciences; social and behavioral sciences; engineering and technology; physical and chemical sciences; and clinical practice. In addition, the *Current Contents* services for life sciences, clinical practice, the physical and chemical sciences, and the social and behavioral sciences include weekly subject indexes to their particular segments of the literature (9,10).

The *SCI* group of services is led by the *Science Citation Index* (11), whose complete multidisciplinary file covers over 3.2 million source items and 36 million cited items. The file is growing at a rate of 400,000 source items and 4.5 million cited items a year, both of which are issued quarterly and cumulated annually and by half decades. To provide current-awareness access to the data base between the

quarterly printed volumes of the service, ISI also makes available the most recent 4 weeks of the data base, which is updated weekly, for on-line remote searches. This aspect of the *SCI* service is a pilot effort that has been available only in England, but is expected to be implemented in some form in the United States in the near future.

Complementing *SCI* is the *Permuterm Subject Index*, which offers title words in permuted pairs as either supplements or alternatives to the *SCI* access points of citation, author, and organization.

The *SCI* group also has a current-awareness component (*Automatic Subject Citation Alert—ASCA*), which announces only the literature that meets the personalized specifications of the subscribers. In addition, the entire *ASCA* system—the *SCI* data base on computer tape and the search software—is leased to subscribers who want to set up their own selective dissemination of information (SDI) service.

In 1973 the *SCI* group was expanded to include two major new services. One is *Social Sciences Citation Index (SSCI)*, with its own *Permuterm Subject Index (I2)*. The other is *ISI's Journal Citation Reports*, a journal-analysis service that uses various types of citation statistics to provide an objective view of the subject orientation of journals and their relative importance as sources of review material and original findings (I3).

The third group of services, *ICRS*, takes its name from the *Index Chemicus Registry System (I4)*, a monthly computer-tape service to the literature of chemical compounds that permits searches by compound family, specific substructure, biological activity, application, analytical methodology, researcher, journal, and standard subject terms. Complementary components in this group are a weekly abstracting service (*Current Abstracts of Chemistry and Index Chemicus*) to the chemical literature; a monthly, printed substructure index (*Chemical Substructure Index (I5)*); and an SDI service (*Automatic New Structure Alert—ANSA*) for the literature of chemical structures.

Outside these three main groups, ISI offers a number of complementary services. A tearsheet service (*Original Article Tearsheet Service—OATS*) supplies items published in journals covered by ISI—an operation that casts the company in the role of being a librarian's library and one of the major sources of journal material in the United States. An annual directory (*Who is Publishing in Science*) provides the names and addresses of scientists who have published during the past calendar year. A search service provides custom searches of the ISI data base by subject-oriented information specialists. An educational service runs scheduled workshops on Wiswesser Line Notation (WLN), a language for describing chemical structures, and custom-designed seminars on the nature, use, and bibliographic methodology of scientific literature. The company also does special contract work involving the development of custom indexes and data bases and studies of the literature, personnel, and communications and development patterns of science and technology.

Collectively, the ISI services amount to a reasonably comprehensive, self-contained, and well-integrated information system that can be put into operation on a turnkey basis. And, in fact, the Spanish government has chosen to do just that—purchasing a custom package of ISI services as the fastest and most practical

way of setting up a national information system for its scientific/technical community. Other developing countries (16) are considering the same approach to the problem of building a stronger research-and-development capability through better utilization of the scientific/technical literature.

Accent on Responsiveness

Garfield's early confidence in commercial motivation and feedback as a way of keeping an organization responsive to the needs of the marketplace appears to have been well placed. ISI has been a dynamic company, not only in the sense of adding to its assortment of services, but also in the sense of dropping, consolidating, and modifying component parts of the assortment.

Sales levels are just one of the measures on which these changes are based. All of the ISI professionals, not only its marketing representatives, stay in close contact with the scientific community, talking to hundreds of customers and noncustomers a year. Special attention is paid to graduate and postdoctoral students, with whom Garfield and several other ISI executives stay in touch by holding teaching positions at the University of Pennsylvania and other institutions. In addition, the company conducts frequent studies, both by mail and personal interviews, to test ideas for new services and modifications of existing ones.

ISI also makes heavy use of its own *Science Citation Index* for marketing intelligence. Special *SCI* studies provide two types of insights: shifts in emphasis from one field or discipline to another and shifts in the relative importance of journals within given fields. This type of information helps ISI spot opportunities for new services and enables it to maintain the quality of its literature coverage.

One factor in the sensitivity of ISI's marketing antennae is competition from the nonprofit organizations in the field. Many government agencies running large-scale information services at public expense tend to give away, literally and figuratively, a lot of scientific/technical information that a commercial organization might sell. Professional societies, subsidized by government agencies, generally sell information services at a price well below commercial levels. Faced with this type of competition, ISI has been forced to become more knowledgeable about the market, and more responsive to its needs, than its nonprofit competitors.

Future

Looking ahead, ISI plans to improve and increase its services in the scientific/technical area. But it is also watching carefully the possibilities developing for information services in other areas. With society becoming information conscious, the company is beginning to identify services it thinks could be sold to the general, consumer market. Though these possibilities would involve developing new markets for types of services that never existed before, ISI does not consider them to be particularly speculative undertakings—certainly no more so than *Current Contents* and *Science Citation Index* were at the beginning.

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