

Values and Future Research Issues in Bibliometrics

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I. INTRODUCTION

If we carefully examine the world we live in, we see that measurement and numbers seem to play an important role in our daily lives. The house we live in is numbered, our height and weight is in numbers, the car we drive or the bus we ride is identified by a number, our names have been given a number, etc. Somehow, we seem to have this tendency to number and measure things. I guess the room for argument is small when observations are represented in a quantitative fashion than in a qualitative mode. Our concern for measuring our performance i.e., where do we stand?, how are we doing?, is it worth it? tends to be partly competitive and partly inquisitive.

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The approach of ranking and evaluating has entered the arena of library and information science, and is used increasingly with the proliferation of computers and the automation of printed material. This process of ranking, evaluation, and to some extent that of prediction is called bibliometrics. Bibliometrics, however, is more than counting. It seeks to gain insight from mathematical distributions so that underlying laws can be uncovered and predictive ability enhanced.

Bibliometrics takes its definition from Pritchard¹⁾ the application of mathematical and statistical methods to books and other media of communication. He also intended to align bibliometrics with other "metrics" (e.g. econometrics, sociometrics). Although bibliometrics has been defined as a distinct field for about twenty years, its literature is growing at a quick pace. Saracevic²⁾ cites the bibliography of bibliometrics studies is a long and exceeds 4,000 citations. This paper in hand attempts to isolate the current research issues in the field of bibliometrics. There are previous publications which describe and appraise the trends in this field. Narin and Moll³⁾ contributed a chapter to *Annual Review of Information Science and Technology* (ARIST) entitled "Bibliometrics." In 1981 *Library Trends* devoted an entire issue to the topic.

Since the Narin and Moll chapter aimed to be a literature review, it presented a well-defined outline of the field of bibliometrics as it was approximately 10 years ago. For an analysis of current bibliometrics

1) Pritchard, A. "Statistical bibliography or bibliometrics." *Journal of the American Society for Information Science* 25(1969): 348.

2) Saracevic, T. "Theories of Information Science I & II." Unpublished class handout. New Brunswick, New Jersey: School of Communication, Information and Library Studies, Rutgers, The State University of New Jersey(1988).

3) Narin, F. and Moll, J.K. "Bibliometrics," in *Annual review of Information Science and Technology*, M. Williams ed.(1977): 35-38.

trends, I chose to follow this outline discussing the concerns of current research in each area and noting how they have changed over the decade. And I also simultaneously attempt to state their applications and direction in which they are moving. The majority of the research in this paper is mid-and late-1980s.

II. BIBLIOMETRIC DATA

The unit in a bibliometric count can be one of many things—publication, journal article, citation, reference, patent, author—to name a few. In 1977, the most active area of bibliometric data was citation counts. This was certainly an area of high interest in 1989, although bibliometrics has moved into other areas. While I will cite several articles which can be called innovative in their unit of bibliometric data, aside from the non-use of patents, the basic units of bibliometric data have not changed over the decade.

The text surrounding references was studied as a bibliometric unit by both Cozzens⁴⁾ and Small.⁵⁾ Cozzens closely examined the text surrounding footnote numbers to see if what is said about a paper when it is cited changes over time. Small extracted representative passages from citing articles which represent the idea of a co-citation cluster. These passages are used to form specialty narratives in scientific fields.

Hurt⁶⁾ used citations as his unit of analysis, but restricted the citation

4) Cozzens, S. E. "Comparing the sciences: citation context analysis of papers from neuropharmacology and the sociology of science." *Social Studies of Science* 15(1985): 127–153.

5) Small, H. "The synthesis of specialty narratives from co-citation cluster." *Journal of the American Society for Information Science* 37(1986): 97–110.

6) Hurt, C. D. "Identification of important authors in science: a comparison of two methods of identification." *Information Processing & Management* 21(1985): 177–186.

study to those citations which refer to the "Methodology Section" of a paper. In a more recent work⁷⁾, he again used a subset of citations. In this case, "conceptual references" were studied to see if there are differences among disciplines or between methodological and conceptual citations.

In a review of methods used to identify important scientific literature, it was noted that citation analysis is following a trend toward the study of smaller groups.⁸⁾ I found this to be true in the more recent literature. Analysis has turned not only from the journal to the journal article, but from the article to the citation.

III. MODERN BIBLIOMETRIC TECHNIQUES

The bibliometric techniques in fashion in 1977 included bibliographic coupling, co-citation analysis, measurement of journal impact or influence and measurement of the relationships between interdisciplinary journals. Bibliographic coupling is no longer used as a technique to establish relationships between scientific papers. Co-citation analysis, however, has developed into highly sophisticated method employing the techniques of multidimensional scaling(MDS) and cluster analysis. New methods for assessing the importance of journals have been developed. Online searching techniques, used in support of citation analysis, have been discussed.

7) Hurt, C. D. "Conceptual citation differences in science, technology, and social sciences literature." *Information Processing & Management* 23(1986): 1-6.

8) Hurt, C. D. "Important literature identification in science: a critical review of the literature." *Advances in Librarianship* 13(1984): 239-258.

Basic citation counting was used by Bruer,⁹⁾ Hurt^{10, 11, 12)} Lancaster and Lee¹³⁾, and Wallace.¹⁴⁾ Bruer looked for a relationship between frequency of citation and methodological rigor in continuing medical education literature. Using the disciplines of sociology, engineering and physics, Hurt looked at methodological citation differences and conceptual citation differences. Citation frequency ranks were used by the same author to identify important authors in the area of quantum mechanics. In an attempt to identify key issues, Lancaster and Lee tracked the rate of citation growth in the literature of the issue and its citation rate in different databases. A traditional approach, analyzing citations by age and nation, was used by Velho and Krige¹⁵⁾ in an investigation of communication patterns in Brazilian agricultural science. Wallace feels that journal productivity and obsolescence have dominated the literature of bibliometrics to a considerable degree. A recent study by this author looked for a relationship between productivity and obsolescence.

As noted in the previous section, Cozzens developed the technique of citation context analysis. Diodato¹⁶⁾ extended citation research into

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- 9) Bruer, J.T. "Methodological quality and citation frequency of the continuing medical education literature." *Journal of Documentation* 41(1985): 165-172.
 - 10) Hurt, C.D. op. cit. pp.177-186.
 - 11) Hurt, C.D. "Methodological citation differences in science, technology, and social sciences literatures." *Library & Information Science Research* 7(1985): 345-355.
 - 12) Hurt, C.D. op. cit. pp.1-6.
 - 13) Lancaster, F.W. and Lee, J. "Bibliometric techniques applied to issues management: a case study." *Journal of the American Society for Information Science* 36(1985):389-397.
 - 14) Wallace, D.P. "The relationship between journal productivity and obsolescence." *Journal of the American Society for Information Science* 37(1986): 136-145.
 - 15) Velho, L and Krige, J. "Publication and citation practices of Brazilian agricultural scientists." *Social Studies of Science* 14(1984): 45-62.
 - 16) Diodate, V. "A citation analysis of articles in series." *Journal of Documentation* 41(1985): 116-121.

articles in series. Once hundred series of articles were examined to see how well past and future articles in the same series were cited. The results indicated that close to 75 percent of citations from later to earlier articles were in the fair to excellent ranges, whereas only 11 percent of all possible citations from earlier to later articles in a series were of a high caliber.

Co-citation techniques also deal with the relationships between individual scientific papers. Studies by McCain¹⁷⁾, Pickering and Nadel,¹⁸⁾ Shaw¹⁹⁾ and Small²⁰⁾ used co-citation to determine the structure of a literature. McCain used the specialty fields of macroeconomics and fruit fly genetics in testing a method which maps the intellectual structure of these two fields. Pickering and Nadel used multidimensional scaling (MDS) maps of the co-citation analysis of high energy physics in their research. In an innovative examination of MDS maps, they discussed the MDS map in terms of both core and "halo" publications. To discuss this structure it is convenient to imagine sweeping round the map a radial (the hand of a watch say) centered on the core. The underlying structure of co-citation analysis was investigated by Shaw. He looked at the citation threshold, the number of times a document must be cited to be important, and the co-citation threshold, the number of times documents must be co-cited to be meaningful. Using the Random Graph Hypothesis, Shaw tested whether partitions observed through

17) McCain, K. W. "Cocited author mapping as a valid representation of intellectual structure." *Journal of the American Society for Information Science* 37(1986): 111-122.

18) Pickering, A and Nadel, E. "Charm revisited: a quantitative analysis of the HEP literature." *Social Studies of Science* 17(1987): 87-113.

19) Shaw, W. M., Jr. "Critical thresholds in co-citation graphs." *Journal of the American Society for Information Science* 36(1985): 38-40.

20) Small, H. op. cit.

co-citation clustering can be explained by chance. He concluded that at high and low values of the co-citation threshold the statistical validity of the partition is questionable. At higher threshold levels, meaningful pair associations are destroyed, at lower levels meaningless associations are created. Small applied the technique of co-citation clusters to the problem of how to model the thought processes used to construct a review of a field. After co-citation clusters are formed, Small established a path through the cluster network using strong co-citation links. Representative passages from the citing articles were then selected to represent the ideas in each cluster. Finally, traditional sentences were created which express the relationship between the ideas. The final result was a specialty narrative, a textual review of the literature, modeled by a co-citation network.

He and Pao²¹⁾ introduced a new technique for assessing the importance of journals and rank this techniques against four other ranking methods. Although He and Pao method did not correlate with the other methods, their technique alone significantly correlated with expert evaluation. The algorithm proposed by He and Pao accounted for both cited journals as well as those journals that cite key journals. In this way both basic scientific journals and discipline-specific journals can be identified. Along similar lines, Tomer²²⁾ conducted an experiment, using a sample of 1980 *Social Science index*(SSI) journals to determine if Institute for Scientific Information's (ISI) impact factor and immediacy index are significant. He concluded that these measures "produce an

21) He, C. and Pao, M. "A discipline-specific journal selection algorithm," *Information Processing & Management* 22(1986): 405-416.

22) Tomer, C. "A statistical assessment of two measures of citation: the impact factor and the immediacy index." *Information Processing & Management* 22(1986): 251-258.

order not dissimilar to that which is produced by uncorrelated rates of citation”²³⁾ and found that “correlating rates of citation in the manner of Garfield often produces a pronounced advantage for journals which publish sparingly”²⁴⁾. Although the impact factor and immediacy index do produce noteworthy changes in rank and order, the rank / order lists are not significantly different.

It is the introduction of appropriate technology that has made many of the above bibliometric techniques possible. Knapp²⁵⁾ offered suggestions for search strategies that maximize co-citation retrieval while minimizing online time and therefore cost. Searching on pairs of co-cited authors can be a complement to usual subject retrieval methods. White²⁶⁾ demonstrates co-cited author search strategies for single author pairs, systematic pairing of a small group of authors, and free pairing of many related authors from two lists.

IV. VALIDITY OF BIBLIOMETRIC MEASURES

The most common way to validate bibliometric measures is by high correlation with subjective judgements of *productivity*, *importance* and *quality*. More than ten years ago, twenty-four studies verifying this validity were identified. In recent years, validation studies are still common, either as the main focus of research or as a way of validating a new bibliometric technique.

23) Tomer, C. op. cit. p.257.

24) Tomer, C. op. cit. p.258.

25) Knapp, S. D. "Cocitation searching: some useful strategies." *Online* 8(1984): 43-48.

26) White, H. D. "Cocited author retrieval." *Information Technology and Libraries* 5(1986): 93-99.

He and Pao used the subjective judgments of veterinary medicine professionals to corroborate the ranking of journals in that field as produced by their Discipline Influence Score. "It appeared that the rankings according to expert evaluation correlated only with the rankings associated with the Discipline Influence Score."²⁷⁾ Author clusters generated by human card-sorting were compared to computer generated co-citation clusters by McCain. The congruence between the resulting maps led McCain to conclude that co-cited author mapping can validly represent the intellectual structure of the fields of macroeconomics and fruit fly genetics.

When restricted to the same authors, Hurt found that two methods of identifying important authors produced significantly similar names. The two methods used were citation frequency ranks and historical references (citation rank in histories). The field under study was quantum mechanics.

One finds movement away from validation studies dealing with technique toward research dealing with the underlying assumptions of bibliometrics in the works of Shaw and Brooks.^{28, 29)} Shaw's research attempted to validate some of the assumptions that underlie co-citation analysis. The use of citations is attacked because no one knows why authors give citations. Brooks tested various motivational theories for why citations are given by interviewing published faculty members. Persuasiveness was found to be the main motivation for citing. This research was further extended and evidence of complex citer motivations

27) He, C. and Pao, M. op. cit. p. 413.

28) Brooks, T. A. "Evidence of complex citer motivations." *Journal of the American Society for Information Science* 37(1986): 34-36.

29) Brooks, T. A. "Private acts and public objects: an investigation of citer motivations." *Journal of the American Society for Information Science* 36(1985): 223-229.

was found.

V. BIBLIOMETRIC LAWS AND DISTRIBUTIONS

Wallace stated in 1986 that "the major areas of concern of bibliometric studies have been: (1) The potential application of bibliometric techniques in libraries or other information systems, and (2) the development and refinement of mathematical descriptions of bibliometric phenomena."³⁰⁾ Chen further subdivided the research agenda of mathematical descriptions of bibliometric laws. "These efforts have focused on four research questions: equation formulation, parameter estimation, goodness of fit, and finding underlying mechanisms that explain the relationships."³¹⁾ In my review of current research of bibliometrics I found no less than eleven research articles concentrating on one of the aspects of bibliometric laws and distributions outlined by Chen. In comparison to the Narin and Moll review, it would seem that this area is still at the research front of bibliometrics. To date, consensus has not been reached in regards to either the relationship among Lotka's law, Bradford's law and Zipf's law or to the explanations and generalizations that underlie the equations. New laws and distributions are being formulated which claim to have a better fit with previous bibliometric data sets.

The history of bibliometrics shows that the field of bibliometric laws and distributions has its Big Three—Lotka, Bradford and Zipf. Much

30) Wallace, D. P. "The relationship between journal productivity and obsolescence." *Journal of the American Society for Information Science* 37(1986): 136-145.

31) Chen, Y. S. and Leimkuhler, F. F. "A relationship between Lotka's law, Bradford's law, and Zipf's law." *Journal of the American Society for Information Science* 37(1986): 307-314.

research in the past few years has been conducted with the laws associated with those names. Brookes added an empirical "anomalous" law of numbers to the Big Three and reduced all laws to the same basis—frequency distributions. He contends that "beneath their confusions there lurks a simple distribution which embraces them all but which remains to be identified" and concluded that the reduction of the four laws "to a single law is achieved by NOT equating the ordinals 1st, 2nd, 3rd...to the number 1, 2, 3."³²⁾ An attempt is made to prove that the Big Three are mathematically equivalent under certain conditions was also made by Chen and Leimkuhler.³³⁾ Although they do not explicitly describe the phenomenon, they believe that the three laws are different ways of looking at the same phenomenon.

Two highly mathematical studies by Egghe³⁴⁾ and Egghe and Rousseau³⁵⁾ use additional laws and distributions. In the earlier study, Egghe introduced the classical laws of Bradford, Leimkuhler, Lotka, and Mandelbrot and suggested a unifying terminology: items (journals, researchers, or words) and yields (articles, publications, or occurrences). A very mathematical proof of the equivalence of Bradford and Leimkuhler was shown, while aberrations from Leimkuhler's law, especially the Gross droop, were studied.

Research is still being conducted which examines single laws. Pao suggested steps to be followed to properly test Lotka's law after a

32) Brookes, B. C. "Ranking techniques and the empirical log law." *Information Processing & Management* 20(1984): 37-46.

33) Chen, Y. S., and Leimkuhler, F. F. op. cit.

34) Egghe, L. "Consequences of Lotka's law for the law of Bradford." *Journal of Documentation* 41(1985): 173-189.

35) Egghe, L. and Rousseau, R. "A characterization of distributions which satisfy Price's Law and consequences for the Laws of Zipf and Mandelbrot." *Journal of Information Science* 12(1986): 193-197.

literature review led her to the conclusions “that no uniform method exists for collecting and organizing data for Lotka’s test” and that “Lotka’s original inverse power law has not been properly tested.”³⁶⁾ Nicholls modified the Pao procedure by formally defining the criteria for data truncation and including all collaborating authors in the productivity measure. After applying the modified procedure was applied to 15 classic databases, he concluded that Pao’s procedure “is a rationalization of the best methods employed by previous investigators”³⁷⁾ but prefers his modifications. Pao continued to empirically test Lotka’s law by retesting 48 data sets using a common method. Nine data sets did not fit Lotka’s law. Factors that may have affected these nine sets include irregular sampling technique and lack of detail in the data set. Time frames did not appear to affect the law since time frames ranged from over 100 years to one year. When all data sets were tested against the inverse square relation, only 7 fit with $N=2$. Pao concludes that “the two constants in Lotka’s formulation...must be derived from the observed distribution”³⁸⁾

Only one article focused on Bradford’s Law. Maintaining that Bradford’s Law can be formulated both verbally and graphically, Maia and Maia derived a mathematical expression from the verbal formulation which produces curves which agree with the graphical formulation. This suggests to the authors that “there is no ambiguity between the two

36) Pao, M. L. “Lotka’s law : a testing procedure.” *Information Processing & Management* 21 (1985): 305–321.

37) Nicholls, P. T. “Empirical validation of Lotka’s law.” *Information Processing & Management* 22(1986): 417–419.

38) Pao, M. L. “An empirical examination of Lotka’s law.” *Journal of the American society for Information Science* 37(1986): 26–33.

formulations and that one is a consequence of the other."³⁹⁾

A new bibliometric distribution was proposed by Sichel⁴⁰⁾, who felt that in past testing, although many authors have "fitted" observed bibliometric distributions to a variety of discrete probability functions, the postulated "laws" looked very shaky if an objective goodness-of-fit test was applied. Sichel found that the Generalized Inverse Gaussian-Poisson distribution performs better than other models as measured by the objective chi-square test. One exception to this distribution is the library book circulation frequency distribution during a fixed time interval. Verification of Sichel's claim that the inverse Gaussian-Poisson distribution fits many bibliometric data sets was given by Cocks and Brookes⁴¹⁾, although the authors did have some difficulty in its application.

Burrell⁴²⁾ attempted to justify the 80 / 20 rule which states that 80 percent of a library's circulation is accounted for by 20 percent of the holdings. Using data from 7 studies, the author was unable to validate the rule and found that the ratio is closer to 80 / 50. Libraries with lower average borrowings tend to require larger proportions of their collections to account for 80 percent.

39) Maia, M. J. and Maia, M. D. "On the unity of Bradford's law." *Journal of Documentation* 40(1984): 206-216.

40) Sichel, H. S. "A bibliometric distribution which really works." *Journal of the American Society for Information Science* 36(1985): 314-321.

41) Cocks, T. M. and Brookes, B. C. "Sichel's unification of bibliometric frequency distributions." *Journal of Information Science* 12(1986): 45-51.

42) Burrell, Q. L. "The 80 / 20 rule: library lore or statistical law?" *Journal of Documentation* 41(1985): 24-39.

VI. APPLICATIONS OF BIBLIOMETRIC TECHNIQUES

As mentioned earlier, bibliometrics, like econometrics and sociometrics, converts observations into a numeric factor which "appear" to be unbiased. One cannot ignore the descriptive impact, nor the provocative nature of the patterns and relationships this techniques provides through the distributions it isolates. Narin and Moll predicted that future reviews of bibliometrics would treat the applications in librarianship and information science in greater depth. While almost any of the bibliometric studies that I have described above could have applications for these fields, several studies explicitly have practical application as an objective.

The Burrell study can be applied to the problems of collection management, especially questions of remote storage. He and Pao's journal selection algorithm will identify both basic science journals and those journals which are specific to a discipline. The inclusion of important journals outside a field make this a particularly useful method. Wallace's conclusion that two measures of journal importance (productivity and obsolescence) are to a certain extent opposed to each other is a caution that when bibliometric studies are used for journal appraisal more than one bibliometric characteristic should be taken into account.

An innovative use of bibliometric techniques is that of Lancaster and Lee who use citation growth as identified by online searching to recognize key issues. Using acid rain as their test case, the authors show how an important issue will move from pure science to applied science to the popular press to Congressional testimony. This technique holds great promise for issues management.

White successfully used co-citation retrieval strategies in the databases

Social Scisearch to obtain a mailing list of writers who has contributed to the field of Science and Technology Indicators. This was done by identifying those authors who had co-cited authors mentioned numerous times in two texts, *Science Indicators 1980* and *Toward a Metric of Science*.

Pao (who has done a great deal of research in the area of bibliometric laws and distributions) and McCreery used Markov chains to predict publication trends. Their predictions were tested against actual volumes of a print index. Although the limited data did not allow unqualified verification, the "properties of the Markov chains can be utilized to describe and predict the pattern of movements of authors in research areas of a subject..."⁴³⁾ Also concerned with prediction is Bruer. His research found a positive, significant but low correlation between citation frequency and methodological rigor. If future research in this area confirms Bruer's findings, citation frequency can be used as an indicator of quality research reports.

A second area of application for bibliometrics is the study of science and scientists. Cozzens work in the field of the sociology of science is a good example. Her paper tries to explain differences in social organization among scientific communities. Her approach to this problem is observation of the way those communities produce bodies of knowledge. Using the methodology of citation context analysis, her findings indicated that references in a science paper changed markedly over time, whereas, references in the sociology paper did not. The lack of change in the sociology paper is attributed to the lack of attention given to

43) Pao, M. L. and McCreery, L. "Bibliometric application of Markov chains." *Information Processing & Management* 22(1986): 7-17.

its main empirical knowledge claim. Hurt continues to study the disciplines of sociology, engineering and physics, looking for similarities among the three by measuring different types of citations. His work indicates that the areas of technology and social science share more in common with each other than with science.

Also the social study of science, Pickering and Nadel seek to establish the complementary nature of quantitative and interpretative methods. They demonstrate that it is possible to carry out a citation and co-citation analysis which can test a detailed interpretative account. This study can be seen as a possible model for the integration of these two approaches to social studies of science. Small also uses co-citation to produce a textual review of a field.

Citation studies of national literature are no longer in vogue. Internationally, it is being used by developing and third world countries to access the production of their scientists and for some to access the impact their countries researchers have had upon a given field.⁴⁴⁾ These studies may well result in future national information planning, policy making and in the allocation of resources, both in terms of manpower and finances. World wide industry usage is strong, basically, in the area of patent analysis, and identification of areas for future research,⁴⁵⁾ and its application in collection development and in the management of information centers, both in the public sector and in the private sector.⁴⁶⁾

44) Lancaster, F.W., Mehrotra, R. and Otsu, K. "Some publication patterns in Indian and Japanese science: A bibliometric comparison." *International Forum on Information and Documentation* 9(1984): 11-16.

45) Koenig, M. "Bibliometric indicators versus expert opinion in accessing research performance." *Journal of the American Society for Information Science* 34(1983): 136-145.

46) Turock, B. "Collection management and bibliometrics in the public library." *Public Library Quarterly* 3(1982): 3-10.

VII. CONCLUSIONS / CONNECTIONS

The current research issues in bibliometrics fall into three areas: bibliometric laws, applications and techniques. The question "How are the various bibliometric laws related?" has yet to be answered. There is interest among researchers in answering this question, but the underlying question "What phenomena are explained by bibliometric laws?" is largely ignored. There is a great need for explanatory theory. It may come from outside information science as statisticians are increasingly drawn into bibliometrics. Although much research is conducted in the area of bibliometrics, there is no evidence of new techniques since Small's introduction of co-citation analysis in 1973. Instead, one finds affirmation or improvement of previous methods. Applications of bibliometrics continue to grow in both the areas of libraries and study of science. There are still problem areas to be addressed.

The first connection between bibliometrics and communication science is that both lack research that is problem-based. It is not within the scope of this paper to address the issue of "research for research's sake" so I will not. I will, however, point out that research in both areas can be driven by technology rather than practical need. In bibliometrics, it would be impossible to do the extensive co-citation analyses reported above within computers. The ability of ISI to maintain and continue citation indexing is totally dependent on computing facilities. In the area of mass media, many scholars discussed a lot of articles which based their research methods on electronic papers. Rogers⁴⁷⁾ talks about content

47) Rogers, E. M. *Communication Technology: The new media in Society*. New York: The Free Press(1986).

analysis as a new research method in *Communication Technology*. Diffusion studies were encountered that focused on diffusion of innovation—that innovation in several studies was the microcomputer. There is danger in both fields that researchers will study that which is easiest and continue to direct their efforts where technology leads.

The Lancaster and Lee piece which applied bibliometric methods to issue management is rather similar to diffusion of information. In the same way that communication scientists trace the spread of information through a society, Lancaster and Lee looked at how a public issue is transmitted from one part of the bibliographic structure (e.g., pure science) to another (e.g., popular press). The methods are different for each type of research but there is a common assumption, that the spread of information is a process, underlying both.

I see further connections between bibliometric studies and mass media studies. Much of the research in these areas concentrates on a part, rather than the whole. Citation studies look at references rather than articles; content analysis of television programs concentrates on individual actions rather than the entire program. In bibliometrics one can see a tendency to look at a citation within the context of the article. I did not see a similar trend in mass communication.

Both information science and communication science assume the existence of objective knowledge. The basic unit of research in bibliometrics is scholarly communication, which can be defined as the social phenomenon where by intellectual and creative activity is transmitted from one scholar to another via journal. At this basic level, bibliometric studies are a form of interpersonal communication. There is no better argument to be offered in behalf of the connection between bibliometrics, a subfield of information science, and communication science.

도서관/정보학적 측면에서 본 계량서지학의 가치와 중요성 및 연구방향 제시

정 동 열*

초 록

계량서지학이 도서관 정보학 분야에 응용된지 20년이 지난 지금, 이론 및 실무에 남긴 발전적 기여를 고찰함과 동시에, 컴퓨터를 비롯한 정보기술의 발달로 계량서지학의 가치와 중요성은 한층 더 폭넓게 인지되고 있다. 본 연구는 계량서지학의 개념 정리와 그 특성을 분석함으로써 다양한 이론적 근거 및 장·단점을 파악하여 향후 연구방향 설정에 기초를 제시함을 그 목적으로 한다.

문헌구조를 분석하는 군집분석(cluster analysis), 동시인용분석(co-citation analysis), 인용문맥분석(citation context analysis), 다차원축적기법(multidimensional scaling technique) 등에 대한 최근의 연구 동향 및 추이를 분석함으로써 도서관 실무 혹은 정보시스템에 계량서지학의 실제 응용을 제시하였다. 아울러, 계량서지학의 3대법칙—Lotka's law, Brandford's law, Zipf's law—의 발달 단계, 상관관계 및 응용분야를 연구함으로써 전반적인 도서관 관리와 이론정보학의 연구방향을 설정하고 있다.

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