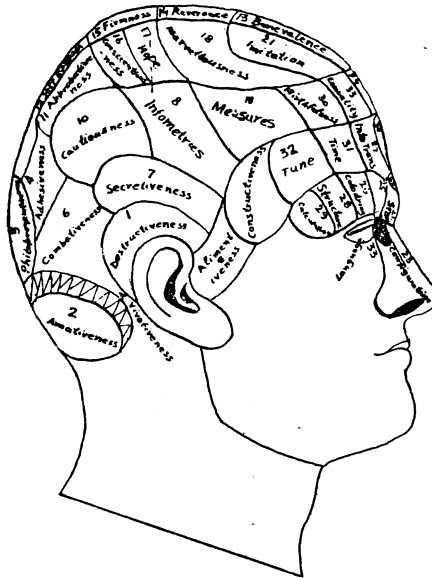


WORKSHOP PROCEEDINGS



THIRD INDO-US WORKSHOP ON SCIENTIFIC AND TECHNOLOGICAL INFORMATION

10-12 MARCH, 1980



सत्यमेव जयते

DEPARTMENT OF SCIENCE AND TECHNOLOGY
GOVERNMENT OF INDIA
TECHNOLOGY BHAWAN, NEW DELHI-110029

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Future Research Directions in the Economic Analysis of Information Systems

Michal David Cooper

Within the past ten years a new tact has been taken in the evaluation of library and information systems and has assumed the form of an economic analysis of these systems. The purpose of this paper is to outline the scope of this emerging field and outline the direction that its research should take. The topics to be discussed are micro-economics, macro-economics, public finance, welfare economics, labor economics, and cost analysis, as applied to library and information systems.

Micro-Economics

Micro-economic analysis of information systems and services has occurred in four areas: demand analysis, price determination, and calculation of production and cost functions.

The demand for various types of information services can be estimated in many ways including economic analysis. The work by Zweizig [61] is typical of the behavioral approach in which a number of socio-economic and demographic variables are used to predict library use. Morse's method [40] uses mathematical models to predict book use based on subject category and past circulation history. The economic approach examines the relationship between price and quantity. Casper's work (11) is an excellent example of that technique.

As part of demand analysis it is necessary to analyze pricing of services. In many cases information is supplied free of direct charge, but there is a growing tendency to impose fees for certain types of services (e.g. on-line searching). Setting prices for public sector products is extremely complex because of welfare considerations and also because of potential conflict with private industry. Welfare considerations in price determination involve analyzing the extent to which individuals economic well-being is affected by prices. The issue of conflict between the public and private sector will be addressed in a subsequent section of the paper. A number of authors have explored the pricing issue including Casper (12), Cooper (17), and Kind (29). The question of whether there should be direct charges for public sector products, and the scope of existing charges, is discussed by Mushkin (41). Various appro-

aches to price-setting are analyzed by Baumol and Bradford (4), Lutz (36), and Zais (60). Baumol and Bradford discuss the use of marginal cost pricing. Their theory suggests that price be determined by analyzing price elasticity of demand. Lutz and Zais surveys a number of strategies that can be used in setting prices, and Zais analyzes how prices should be set for an information product using marginal cost pricing concepts.

Demand analysis relates the price to the quantity of information supplied. Production functions relate the quantity of outputs or services produced to the cost of providing that service. One objective of such an analysis is to see the relation between the size of an organization and its cost per unit of service. Research on the use of production functions has begun only recently. This methodology is used to determine the appropriate size of an institution providing information services, and one part of it is to determine whether or not economies of scale exist. An analysis of economies of scale involves determining whether the cost per unit of output increases, decreases, or remains the same as the size of the organization changes. However, the methodology needs better measures of output for use in the production functions. Additive output functions will have to be modified to weigh each output according to the resources used to produce it. Cooper (18), Hayes (27), and Ross (54) have all investigated the problem using different approaches.

There are a number of micro-economic research topics that have not yet been examined. With respect to demand analysis, little is known about how the demand for information changes with its price, or how the demand changes with the income level of the requester. The impact of prices on the social welfare of information users is relatively undocumented and requires considerable more research.

Macro-Economics

Macro-economics analyzes the overall structure of the information sector of the economy. The classic description of the information economy is that by Fritz Machlup (37) (which is in the process of being updated).

Machlup showed that a very large portion of the resources of the United States economy are devoted to the production and distribution of knowledge. The analysis required regrouping the traditional functions of an economy into information and non-information related activities. He included in the information sector such traditional activities as printing and publishing, but also education, legal and accounting assistance, and computing, to name but a few. Porat (49) has performed a similar analysis but with different categories and a slightly different approach.

Discussions of the magnitude of the information sector lead to the question of how it has been growing, and the expected future trends. King et al. (32) presents a comprehensive set of tables and graphs that show statistical indicators of the growth of scientific and technical communication.

Among the topics requiring further attention in this area are an examination of the differences between Machlup's and Porat's conception of the information economy. An important extension of both of their research would be to perform the same analysis in other countries. The feasibility of restructuring the way in which the United States keeps the National Income Accounts must also be examined to see whether "Information" should be included as an explicit account rather than being implicit in others.

Some major sectors of the economy have been analyzed in terms of the types and quantities of raw materials that go into them and the resulting outputs. This type of analysis is worth investigating for use in the information sector.

Public Finance

A public finance approach to information systems and services assumes that the institutions involved are, in fact, 'public' and studies their financing, the distribution of their services to society, and what can be done to improve this distribution. It also considers whether supporting these activities places an unequal burden on individual members of a society. These issues have been analyzed in government organizations other than libraries and information centers; for example, by Cohn (13) and Benson (6) in education and Hirsch (28) in other government services.

Some research has been performed on the public financing of library services. The monograph by Prentice (50) summarizing current methods of financing public libraries is a valuable addition. The Government Studies and Systems report (25) provide details

on public library finance. The work by Aaron (1) and Netzer (42, 43) while not explicitly concerned with information services, are important additions to our understanding of the property tax—the tax used most frequently to support public libraries.

DeWath (22) has applied a time allocation model to the financing of public libraries. In this model, the user explicitly considers the value of his or her time when deciding whether to use the public library to satisfy an information need. DeWath has also analyzed client groups who use the library to determine whether public financing is appropriate, given the client mix.

The way in which libraries in the United States are funded dictates many of the areas of further research. Little analysis has been conducted on whether the federal, state, or local government is the appropriate one to fund libraries; and what proportion of funds should come from each.

In the past there have been Federal assistance acts, such as Revenue Sharing (55), and the Library Services and Construction Act which have distributed funds to local government. Little is known about the effect of such legislation on operating libraries and the constituencies involved.

An important, yet unexplored, area is the amount that people who use information from public sources pay in relation to the value of the information received. Ideally there should not be a disproportionate burden (in relation to ability-to-pay) placed on various groups of users and non-users of information services. Yet, there has been little research to determine if this proposition is true.

Welfare Economics

Related to the public nature of most information systems are welfare economic questions. These pertain to how to set prices for information supplied by public organizations, how to measure the benefits to society of information use and how to determine whether the benefits of information accrue to more than just the immediate receiver of the information (i.e. whether there are externalities).

The section of this paper on micro-economics has outlined some of the issues related to the pricing of information. Central to the topic is whether direct charges should be levied; and in order to answer this, both a measure of the effect of a fee on the user and a measure of the benefit received by society from infor-

mation services is needed. Both are required so that a proper balance can be struck between individual and societal welfare in price determination.

Measuring the benefit of information is the most complex task facing researchers today. There have been attempts at benefit measurement in other fields such as recreation (38), education (6), and economic development (26); and Prest and Turvey (51) have surveyed many others, along with the methodology used in conducting cost benefit analyses. Within libraries, Goddard (24) has attempted to analyze the effect of information services on certain client groups. Newhouse and Alexander (44) estimated benefit according to how much a user would be willing to pay for library services, and Braunstein summarized some of the problems (9).

A number of topics in welfare economics of information bear further investigation. There has been some discussion in the literature of the concepts of externalities, merit goods, and public goods as they apply to information, and elaboration is called for, especially with regard to refinement of their definitions. Considerable work needs to be done in developing benefit measures.

Public—Private Issues

A micro-economic versus a welfare economic approach to the analysis of information systems and services implies two alternative views of the way in which allocation decisions are made. Private enterprise relies on the market mechanism (the price system) to determine who receives services. Welfare economics relies on benefit measures to substitute for prices in the market allocation scheme. The major providers of library-type services in the United States was government agencies who generally obtain their information from publishers. The situation has changed in recent years with considerable entrepreneurial activity in the information sector and with the formation of trade groups such as the Information Industry Association.

Many difficult problems arise when both private enterprise and public organizations produce and supply information. For example, how much information should be supplied by government versus private organizations? Should the government sell information to the private sector and let the private sector distribute it to the public? What problems of social equity are raised by public vs. private provision of information? Most of these topics have yet to be addressed.

Productivity

Automation has had considerable impact on the provision of information services. Not so obvious, but certainly important, is the ongoing attempt by most organizations to improve the productivity of their workers with better procedures and systems.

The productivity of individuals in manufacturing organizations has been measured for a considerable length of time and is regularly reported in U.S. government publications. The difficulty comes when the same techniques are applied to service organizations. Productivity is a measure of the output produced each hour a person works. In manufacturing organizations, like a steel mill, such computations are relatively straightforward. But in the case of a library or information center it is much more difficult to characterize the output or develop an output function. Some attention has been given to this problem within government (2, 39) and Cooper (18) has discussed the problem of output measures in libraries. Once these measures have been defined and validated, productivity measurement can be applied to information organizations on an ongoing basis.

Labor Economics

Information systems and services require qualified individuals to operate them. The scope of inquiry into the needs of the information profession is very broad. It includes analyzing the educational requirements; the types of training programs that exist and that need to be developed; and the number of individuals already in, and required in, the profession.

Cooper (115) has surveyed some of the factors that influence the demand for librarians. The U.S. Bureau of Labor Statistics (BLS) (56) has analyzed the supply and demand for librarians in the United States and has made projections of that demand. Cooper (16) performed a similar analysis for the State of California.

Neither the BLS nor Cooper has considered personnel classifications other than those of librarian or library assistant, a study in progress at the University of Pittsburgh (53) takes a much broader view. It attempts to define an 'information professional' and includes in the definition many other types of workers beside librarians. Once this definitional study is completed, it will be possible to analyze personnel needs in a much broader context.

Numerous issues remain to be explored within the area of the library and information science labor force:

the wages and salaries of information professionals, the tradeoff between the use of paraprofessionals and professionals in information activities; and the reasons why those trained for the information profession leave it or never enter it. Quantitative data is lacking on retirement rates, unemployment rates, benefits, working conditions, and migration patterns. The models used to predict demand for and supply of workers are elementary and need further elaboration and validation.

Cost Analysis

Cost analysis is the most prevalent type of economic analysis of information systems and services. Among the organizations that have been studied are libraries, publishers, information centers, clearinghouses, document reproduction facilities, on-line search services, and data base producers;

Typical cost studies of libraries include those that have analyzed just the processing costs of library operations (10), (46), (34), reference and interlibrary loan costs (47), as well as all aspects of library costs (57, 58). Cost analysis of document processing and distribution facilities received a careful treatment from Price (52).

Several articles have investigated the costs and economics of journal publishing. Berg (7, 8) has developed cost equations, Baumol and Braunstein (5) have analyzed economies of scale and costs, and King et al. (31) have taken a comprehensive look at many aspects of scientific journals.

On-line search services have also been the subject of cost analysis. Cooper and DeWath (20) have studied the time and cost involved in performing a search, and in a separate study (21), have analyzed how the costs change when fees for the search service are instituted. Elchesen (23) has compared the cost of performing manual versus on-line searches.

Another aspect of cost analysis that has come under scrutiny is cost estimating equations. Baumol and Marcus (3) analyzed costs in academic libraries of different sizes, types (2-year, 4-year, university), and

institutional control (public, private). Williams et al. (59) and Palmour (45) have studied the costs of owning journals in one's own library as opposed to borrow in them when needed. Wiederkehr of King Researchg in the process of developing a model to predict this costs of maintaining a library card catalog in its presence form versus converting it to microform or to an on-line system. Cooper (19) has derived cost estimating relations for the on-line search process.

The references cited in this section are indicative of a large body of work analyzing costs. More research needs to be done. For example, there is still little effort devoted to the implementation of ongoing cost collection and monitoring systems. Aside from a few notable exceptions (57, 58), little data has been generated to allow valid cost comparisons between libraries.

While some studies have been performed on the costs of on-line systems to users, no published information is available on their computing (or internal processing) costs. Furthermore, little is known about the marginal costs of on-line searching and their relation to the capacity of the computer systems.

For the most part, journal, abstract, and index publishing is a proprietary activity and little appears in the literature on its economics: Nevertheless, a number of issues deserve analysis, one of the most important of these is the problem of a user accessing information through an on-line search service or through the hard-copy version of the document. (30). Depending on how the publisher sets the price of a hard copy as opposed to a computer tape version of the data base, a shift to more on-line use can change the economics of the publishing program considerably.

Summary

This paper has reviewed the scope of economic analysis of information systems and services. Considerable progress has been made in the analysis of these systems using the tools of economics, and the paper shows that there are many topics yet to be addressed and still others that deserve further research.

REFERENCES

1. Aaron, Henry J. *Who Pays the Property Tax? A New View*. Washington, D.C.: The Brookings Institution, 1975.
2. Ardolini, Charles and Jeffrey Hohenstein. "Measuring Productivity in the Federal Government." *Monthly Labor Review* (November 1974) 13-16.
3. Baumol, William J. and Matityahu Marcus. *Economics of Academic Libraries*. Washington, D.C.: American Council on Education, 1973.
4. Baumol, William J. and David F. Bradford. "Optimal Departures from Marginal Cost Pricing." *American Economic Review* 60:3 (June 1970) 265-283.
5. Baumol, William J. and Yale M. Braunstein. "Empirical Study of Scale Economies and Production Complementarity: The Case of Journal Publication." *Journal of Political Economy* 85 (Oct. 1977) 1037-1048.
6. Benson, Charles S. *The Economics of Education*, 3rd ed. Boston: Houghton Mifflin Co., 1978.
7. Berg, Sanford V. "An Economic Analysis of the Demand for Scientific Journals." *Journal of the American Society for Information Science* 23:1 (Jan./Feb. 1972) 23-29.
8. Berg, Sanford V. *Structure, Behavior, and Performance in the Scientific Journal Market*. Ph.D. Dissertation, Yale Univ., 1970.
9. Braunstein, Yale M. "Costs and Benefits of Library Information: The User Point of View." *Library Trends* 28:1 (Summer 1979) 79-88.
10. California. State Universities and Colleges. Division of Academic Program and Resource Planning. *Report on a Cost Study of Specific Technical Processing Activities of the California State Colleges Libraries*. Los Angeles: Library Systems Project, Office of the Chancellor, California State Universities and Colleges, 1973.
11. Casper, Cheryl A. *Library Pricing Models and Informational Requirements: A Case Study*. Ph.D. Dissertation, Case Western Reserve University, 1975. (University Microfilms 175-27891).
12. Casper, Cheryl A. "Pricing Policy for Library Services." *Journal of the American Society for Information Science*, 1979 (in press).
13. Cohn, Elchana *The Economics of Education* Cambridge, Mass., Balinger Publishing Co., 1975.
14. Cooper, Michael D. "A Cost Model for Evaluating Information Retrieval systems." *Journal of the American Society for Information Science* 23 : 5 (Sept./Oct. 1272) 306—312.
15. Cooper, Michael D. "An Analysis of the Demand for Librarians." *Library Quarterly* 45 : 5 (October 1975) 373-404.
16. Cooper, Michael D. *California's Demand for Librarians : Projecting Future Requirements*, Institute of Governmental Studies, University of California, Berkeley, 1978.
17. Cooper, Michael D. "Charging Users for Library Service." *Information Processing and Management* 14 : 6 (1978) 419-427.
18. Cooper, Michael D. "The Economics of Library Size : a Preliminary Inquiry." *Library Trends* 28 : 1 (Summer 1972) 63-78.
19. Cooper, Michael D. "Input—Output Relationships in On-Line Bibliographic Searching." *Journal of the American Society for Information Science* 28 : 3 (May 1177) 153-160.
20. Cooper, Michael D. and Nancy A. DeWath. "The Cost of On-Line Bibliographic Searching." *Journal of Library Automation* 9 : 3 (Sept. 1976) 195-209.
21. Cooper, Michael D. and Nancy A. DeWath. "The Effect of User Fees on the Cost of On-Line Searching in Libraries." *Journal of Library Automation* 10 : 4 (Dec. 1977) 304-319.
22. DeWath, Nancy V. *Demand for Public Library Services : A Public Finance and Time Allocation Approach to User Fees* Ph. D. Dissertation, University of California, Berkeley, California, 1979.
23. Elchesen, Dennis R. "Cost Effectiveness Comparison of Manual and Retrospective Bibliographic Searching." *Journal of the American Society for Information Science* 29 : 2 (March 1978) 56-66.
24. Goddard, Haynes C. "An Economic Analysis of Library Benefits." *Library Quarterly* 41 : 3 (July 1971) 244-255.
25. Government Studies and Systems, Inc. *Alternatives for Financing the Public Library*. Washington, D.C.: National Commission on Libraries and Information Science, 1974.
26. *Guide to Practical Project Appraisal : Social Benefit Cost Analysis in Developing Countries*, United Nations, 1978. Sales No. 78.2. B, Document No. ID/Ser. H/3 Project Formulation and Evaluation Series 3.
27. Hayes, Robert M. "The Management of Library Resources : The Balance Between Capital and Staff in Providing Services". *Library Research* 1 : 2 (1979) 110-149.
28. Hirsch, Werner Z. *The Economics of State and Local Government*. New York : McGraw Hill, 1970.
29. King, Donald W. "Pricing Policies in Academic Libraries." *Library Trends* 28 : 1 (Summer 1979) 47-69.
30. King, Donald W. "A Potential Pitfall in the Economics of Information Products and Services," *Bulletin of the American Society for Information Science* (June 1977).
31. King, D.W., D.D. McDonald and N.K. Roderer. *The Journal in Scientific Communication : The Roles of Authors, Publishers, Libraries, and Readers in a Vital System*. Rockville, MD., King Research, Inc., May 1979. (PB 296263).
32. King, D.W., D.D. McDonald, N.K. Roderer and B.L. Wood. *Statistical Indicators of Scientific and Technical Information Communication (1960-1980). Volume I: A Summary Report*. U.S. Government Printing Office, Washington, D.C., 1976 Stock No. 038-000-00295-3.

33. Lancaster, F. Wilfrid. *The Measurement and Evaluation of Library Services*. Washington, D.C. : Information Resources Press, 1977.
34. Leimkuhler, Ferdinand F. and Michael D. Cooper. "Cost Accounting and Analysis for University Libraries." *College and Research Libraries* 32 : 6 (November 1971) 449-464.
35. Levy, Frank, Arnold J. Meltsner and Aaron Wildavsky. *Urban Outcomes : Schools, Streets, and Libraries*. Berkely, Ca. : Univ. of California Press, 1974.
36. Lutz, Raymond P. "Costing Information Services." *Bulletin of the Medical Library Association* 59 : 2 (April 1971) 254-261.
37. Machlup, Frirv. *The Production and Distribution of Knowledge in the United States*, Princeton, New Jersey : Princeton University Press, 1962.
38. Mack, Ruth P. and Sumner Myers. "Outdoor Recreation." In : Robert Dorfman (Ed.) *Measuring Benefits of Government Investments*, Washington, D.C. : Brookings Institution 1965, 71-116.
39. Mark, Jerome A. "Progress in Measuring Productivity in Government." *Monthly Labor Review* (December 1972) 3-6.
40. Morse, Philip M. *Library Effectiveness : A System Approach*. Cambridge, Massachusetts, MIT Press, 1968.
41. Mushkin, Selma J., ed. *Public Prices for Public Products*. Washington, D.C. : The Urban Institute, 1972.
42. Netzer, Dick. *The Economics of the Property Tax*- Washington, D.C. : The Brookings Institution, 1966.
43. Netzer, Dick. "The Incidence of the Property Tax Revisited." *National Tax Journal* 26 : 4 (December 1973) 515-535.
44. Newhouse, Joseph P. and Arthur J. Alexander. *An Economic Analysis of Public Library Services : Prepared for the City of Beverly Hills*. Santa Monica, Ca. : Rand, 1972.
45. Palmour, Vernon E., Marcia C. Bellasai and Robert R.V. Widderkeher. *Costs of Owning, Borrowing, and Disposing at Periodical Publications*, Arlington, Virginia : Public Research Institute, October 1977.
46. Palmour, Vernon E., Edward C. Bryant, Nancy W. Caldwell and Lucy M. Gray. *A Study of the Characteristics, Costs, and Magnitude of Interlibrary Loans in Academic Libraries*. Westport, Conn. : Greenwood Publishing Co., 1972.
47. Palmour, Vernon E. and Lucy M. Gray. *Costs and Effectiveness of Interlibrary Loan and Reference Activities of Resource Libraries in Illinois*. Springfield, Illinois : Illinois State Library, 1972.
48. Pfister, Richard L. and Jerome W. Milliman. *Economic Aspects of Library Service in Indiana*. Bloomington, Ind. : Institute for Applied Urban Economics, Graduate School of Business, Indiana University, 1970. (Indiana Library Studies, Report 17).
49. Porat, Marc U. *The Information Economy*. 8 vols. U.S. Department of Commerce, Washington, D.C., May 1977.
50. Prentice, Ann E. *Public Library Finance*. Chicago : American Library Association, 1977.
51. Prest, A. R. and Ralph Turvey. "Cost-Benefit Analysis : A Survey." *The Economic Journal* 75 : 300 (December 1965) 683-735.
52. Price, Douglas S. *Collecting and Reporting Real Costs of Information Systems*. American Society for Information Science, 1971, Washington, D.C. : (Tutorial Presented at the American Society for Information Science Annual Meeting).
53. *Progress Report on : A Survey of Professional Manpower Requirements for Scientific and Technical Communication*, University of Pittsburgh, Pennsylvania, March 20 1979 (NSF Project No. DSI-7721175).
54. Ross, Myron H. "Accountability, Productivity, and the Impending Crisis in the Public Library". *Journal of Economics* 3 (1977) 165-168.
55. State and Local Fiscal Assistance Act of 1972, Public Law 92-512, 20 Oct. 1972.
56. U.S. Bureau of Labour Statistics. *Library Manpower : A Study of Demand and Supply*. Bulletin 1852, U.S. Government Printing Office, 1975.
57. Western Interstate Library Coordinating Organization. *Survey of Costs in Technical Processing and Interlibrary Loan : Summary* by Maryann Kevin Brown and Anita L. McHugh, Boulder, Colorado, 1976.
58. Western Interstate Library Coordinating Organization. *Survey of Costs in Technical Processing and Interlibrary Loan : Survey Cables and Results of Case Studies*, Eleanor Montague Program Director, et. al. Boulder, Colorado, 1976.
59. Williams, Gordon R. et al. *Library Cost Models : Owning versus Borrowing Serial Publications*. Bethesda, Maryland, Westat. 1968.
60. Zais, Harriet W. *The Pricing of Information : A Model for Selective Dissemination of Information Services*. Ph. D. Dissertation, University of California, Berkeley, 1971.
61. Zweizing, Douglas. *Predicting Library Use : A Study of the Role of the Public Library in the Life of the Adult Public*. Ph. D. Dissertation, Syracuse University, 1973.