STUDIES ON USE OF LIBRARY COLLECTIONS BY SCIENTISTS, ENGINEERS AND TECHNICIANS

M.S. SRIDHAR
ISRO Satellite Centre, Bangalore-560 017

ABSTRACT

This paper stresses the need for user-research and use studies at the individual library level; defines related terms and concepts like user, use, need, want, demand and requirement; reviews some important studies on use of library collections and interaction of scientists, engineers and technicians with libraries. It enumurates the relationships found in past studies between characteristics of scientists, engineers and technicians and their use of library collections as well as their interactions with library. Finally, lack of sound use studies based on critical incident data in the country is pointed out.

1. INTRODUCTION

The user is the key person in any information system. All the luxuries of information revolution and problems of information explosion are centred round the user and his convenience. Understanding the user is half the battle in providing information services. The success of any information system depends considerably on how best the system design is based on a close and accurate understanding of the users. The effectiveness of library and information system depends on the extent to which the system characteristics correspond with the user and on how much the potential user is willing and able to make use of it. System designers, planners and managers have, by and large, failed to properly consider the role of human factors and their effect on acceptance and utilisation of information (Mick, 1980, p. 21). Landau and others (1975, p. 422) say '... in a great majority of cases, the user is neither understood nor studied, nor in some cases even identified until after the system is already evolved or in a completely operational state. Some have characterized this as an upside-down system design'. Brittain (1975, p. 429) says a lip service has been paid to this objective in many studies.

'Know thy customer' isthe cardinal rule of any business enterprise. Accordingly, extensive market research, customer behaviour studies and demand forecasting are carried out in business. A formal information centre or library is yet to pick up these activities in the same spirit. It may be partly due to not-for-profit and paternalistic nature of libraries.

There appears to be a lopsided emphasis in library and information field on user education than on understanding the user. This is largely due to the systems designed and implemented, which are unfriendly, complex and not concerned with the perceived needs of users. What is more important is intensive librarian education about users than mere education of users of the existing system (Thompson, 1982, p. 11). Hoadley and Clark (1972, p. 133) say that a library can achieve its goal '... if the library is more precise about who its users are. This precision, coupled with more research into behaviour and information gathering patterns of these user groups, will assist the library more effectively in developing programmes and using its resources and limited funds to achieve desired goals'. Accurate and upto-date knowledge about users and their information behaviour is one of the essential ingredients for designing an information system. The need is for user-driven design than technology-driven design and more research on human variables of information system than technology and system variables (Atherton, 1975, p. 672). Unfortunately, the emphasis in the profession has been on imparting technical skills than information skills.

Eventhough considerable research has been done in the area of user- and use-studies in developed and information rich countries, especially USA, Britain, and European countries, practically nothing substantial is done in less developed countries in general and India in particular. Not even a single major user- and use-study in any of the areas of science and technology has been done in the country. Even the major national information system designs were

not preceded by systematic, reliable and comprehensive user-studies. As such many present systems are surviving under 'symmetry of ignorance' (Kunz,et al., 1977, p. 67, -68), mathematical induction of convenient good or bad things, subjective considerations and idiosyncracies of people involved in planning information systems. Other systems are thriving under dubious reasons of avoiding the duplication of research and resultant economic benefit arising out of information systems but the hidden apparent reasons of an information system, as Myers (1970, p. 26) says, could be treating information system as a prestige centre or a form of fringe benefit to employees or a paid up insurance to serve an unanticipated need or to sublimate the feeling that one does not read or a centralised way of budgetary control over expenditure on documents.

2 THEORETICAL BACKGROUND AND RELATED TERMS AND CONCEPTS

In the process of seeking information, what mainly takes place is an effort to match a cognitive need of user with a source of information and seeking supply of information to satisfy the need. This process naturally involves many phases and factors. First, the need could be unclear and uncertain. Secondly, user could be biased, subjective, conservative, habituated and having his own styles and idiosyncrasies. Further, apathy towards a new service or system is not unusual and in one case researchers were reluctant towards new services (eventhough they desired) and did not even directly examine· the service attributing it to lack of time (Trueswell,et al., 1965; Van- cott and Kincade, 1967).

The individual's initiative plays an important role to recognise a need for information, to seek and search information and to use it irrespective of availability of services (Wilkin, 1981, p. 4.30). However, this does not underestimate the importance of availability of information facility/service for one to seek and use. Infact, availability or existence of needed information is one of the necessary conditions, next only to the need and the initiative to use. Then comes the sufficient conditions that the available facility/service should not only be accessible to the user but also easy to use. Above all, the user should perceive that the source or facility is useful for the need concerned. The perceived utility of a source is based on both the quantity and quality of

information expected from it. Ignorance about a piece of useful information either due to the apathy of the user or due to the failures of information system when realised leads to alter the composition of monitor, reserve and supply of information in a cost-efficient way to yield a relatively satisfactory information supply provided the ignorance is neither too small to worry about nor too large to be remediable (Wilson, 1977, p. 74). In the process of adaptation of altered system the cost in terms of time and efforts is optimised and sources that adapt to needs of user are preferred to sources which require the user to adapt himself. In other words, personal information gathering is often purposive, adaptive, habitual and economical (Wilson, 1977, p. 80). The lack of awareness on the part of the user about existing information systems could also be a factor for its non-use in addition to convenience, responsiveness and ability to conduct dialogue with the system (Ackoff, et al., 1976, p. 143).

Atherton (1977, p. 7) summarises these factors involved in seeking and using information in the following words. 'The working habits of the individual needing information, the importance placed on getting it, the facilities available for seeking it, the knowledge about the facilities, the judgement of their value, the estimate of the probability of getting what is wanted--all of these factors may affect information seeking behaviour. Unless a person who wants information is fairly sure of getting it without much trouble, he is apt to do without it, if it is not essential. Relying on memory, skirting around the issue or making do with incomplete or vague information from a colleague are not unusual behaviour traits. There is, however, a small group of users who actively seek information spending effort and resources to acquire pertinent information and these users in fact are the most progressive in economic activity'. Scientists and engineers are more likely to invest or reinvest efforts and resources for reinventing than to derive it from the research or development work of someone else, especially someone they don't know, in a different organisation and in a different discipline (Havelock et al., pp. 8-16). They may even estimate that generation of new knowledge will be cheaper than an expensive and possibly fruitless search (Paisley, 1968, pp. 19, 20).

The complex trio concepts, viz., accessibility, 'ease of use' and perceived utility of a channel are extensively investigated by Allen and

Gerstberger (1967, 1968). The concept 'ease of use', which is akin to 'law of least efforts', Mooer's law* and 'why bother theory of information usage' (Cooper,1978) appears to be the supreme criterion in use of a source of information (Rosenberg, 1966, p. 19). Moor (1972) has developed a model incorporating seven dimensions as measurable components of the concept ease of use of an information system. The dimensions are-- movement required (out of the user's personal work area), time delay, interaction, interface structure, required location of use, permanence (nature of information provided) and response filter. The model was empirically tested from the data from R&D personnel and concluded that these dimensions do serve as a model for identifying behaviour.

A use study has to necessarily keep a set of defined population of users in the background. It is also necessary to understand other related concepts and terms like need, want, demand and requirement before commencement of any use study.

'Need' is a more abstract and difficult-to-define concept. Both Ford (1980) and Krikelas (1983, p.6) define 'information need' as an awareness or recognition of not knowing or existence of uncertainty. The draft definitions of 'need', 'want', 'demand', 'use' and 'requirement' in relation to information proposed by Brittain (1971) and supported by Line (1974, p. 87) are quite adequate for the purpose. 'Need' is what an individual ought to have, for his work, his research, his education, his recreation, etc. A need may or may not be identified as want.

The interesting and most practical aspect is that 'needs arise out of the roles an individual fills in social life. So far as specialised information system is concerned, the most relevant of these roles is 'work role', that is, the set of activities, responsibilities, etc, of an individual usually in some organisational setting in pursuit of earnings and other satisfactions' (Wilson, 1981, p.9).

'Want' is what an individual would like to

---

* Users will utilise an information service only when doing so costs them less than not using it (Mooers, 1960, p. (ii)).

have, whether or not the want is actually translated into a demand on the library. Individuals may need an item they do not want, or want an item they do not need. A want, like a need, is a potential demand.

'Demand' is what an individual asks for; more precisely, a request for an item of information which is believed to be wanted. Individuals may demand information they do not need, and certainly need or want information they do not demand. Demand is partly dependent on expectation, which in turn depends partly on existing provision of library or information service. A demand is a potential use.

'Use' is what an individual actually uses. A use may be a satisfied demand, or it may be the result of browsing or a chance. Individuals can only use what is available. Use is, therefore, heavily dependent on provision and availability of library and information service. A use usually represents a need of some kind. But need is independent of use. Uses can be partial indicators of demands, demands of wants, and wants of need. Identification becomes progressively more difficult from the 'hard' use to the often nebulous and unstated need.

The term 'user' includes actual as well as potential users and even non-users. The concept of 'use' is often defined as the extraction of content from a message to meet a need. The operational definition of 'use' for collecting data about the use of the library documents could be stated as physical selection and the act of leafing through pages of document as far as in-house use is concerned (Kent et al., 1979, p. 61) and for circulation or loaned use, each record of having lentout or renewed is considered as one externally circulated use of a document.

'Requirement' is a useful bridging term; it can mean what is needed, what is wanted, or what is demanded, and can therefore be usefully employed to cover all three categories. But the term requirement is closer to the term need. Many studies of needs have infact been studies of requirements.

3. STUDIES ON THE USE OF LIBRARY COLLECTIONS AND USER INTERACTIONS WITH LIBRARY

There have been many use-studies of library collections and a majority have analysed what is used, frequency of use, lifetime and obsolescence rate of material used, etc., with varied objectives. They were also thought of as demand studies. Studies of user interactions with libraries did not receive enough attention in the past. Many indirect studies like bibliometric and citation studies have also attempted to study and determine the use of library collections by scientists, engineers and technicians, but owing to their in-built limitations and non-local scope, their utility and even reliability are limited. The critical incident data of specific demands made on typical libraries should reveal behavioural trends, and indicate their underlying motivation better than a theoretical and qualitative investigation (Slater and Fisher, 1969, p. 1).

At the outset, it should be made clear that the use of a document or library does not imply its utility or usefulness. Nor does a high or intensive user interaction with the library necessarily imply that the user is an intensive user of the library or a highly library dependent user. 'An information system may be used, then, but not be useful; it may also be useful, but not used. It may even be neither useful nor used. It is ideal if it is both used and useful' (Kochen, 1976, p. 150).

Depending on the intensity of use, the users are classified as 'high information-potential' (HIP) and 'low information-potential' (LIP). LIPs are further divided into (i) the nostalgic, who would like to keep informed but never have time, (ii) the bereaved, who think it is now too late to update themselves, and (iii) the lost souls, the confirmed non-users (Shuchman, 1981, p. 1). Secondly, the number of users who have need of information far exceed those who actually use information (Atherton, 1977, p. 7). At the same time, it should also be noted that the services of libraries are not restricted to, those actually use them but reach others via actual users due to 'spillover effect' (Wilson, 1977, p. 83). As a matter of fact the lost souls (among engineers) might be heavy users of information in different forms (Shuchman, 1981, p. 23). Thirdly, the '... concern with users should not be equated with an objective of maximising use (sales)' (Oldman, 1976, p. 37). Lastly, it is not yet established that the use of libraries has any definite influence on anything else (Ford, 1977, p. 101).

4. USE OF LIBRARY COLLECTIONS

One of the ways of exploring use- and user-studies isto study the actual incidents of use of information and documents. By and large, the use of library collection is a 'minority event', i.e., a very small segment of rightful members really use collection of their 'primary library'. Like insurance, for a majority of the users the library appears to be a necessary adjunct to the regular work without much direct consequence attributable to the existence of the library. However, its absence is normally felt by some marginal users too. The studies of Shuchman, Scott, Gilmore and others, Slater and Fisher and that of 'The Social Survey' have very much shown this aspect. For example, The Social Survey, in its survey of UK electrical industrialists found that in the case of those firms which had a library, less than half of them used it and 18 per cent of the respondents said that they did not use libraries of any kind (Scott, 1960, p. 36). Similarly, in the case of Slater and Fisher's survey (1969, p. 21) the ratio of potential users of library to total membership was 26.3 per cent industrial firms and 22.6 per cent for government establishments. Surprisingly the same was as high as 69 per cent in an Indian study (Sridhar, 1985, p. 31 32). A study of Science Library at MIT (Bush, et al. 1956, p. 94) showed that the ratio of visits to enrolment as 0.37 and Shuchman (1981, p. 30)

found' technical libraries serving only a small proportion of the engineers. When the use of library documents is examined, we find that still smaller segment of users use library documents typically following the 80/20 rule.

Just as inter-personal communication follows the inverse square law, the amount of use of a library is also inversely related to the square of the distance between the library and the functional group to which a user belongs (Frohman, 1969). Yet the psychological distance may be more important than physical distance (Line, 1974, p. 48).

Among all types of documents, 'use of journals' has been studied by many with different methodologies. It was found in these studies that a major portion of the reading of the scientists, engineers and technologists is in journals (Shaw, 1971, pp. 23, 24, 32-35, 81 and 82). In journal reading behaviour, 'issues' like how many journal a

12

user regularly reads, how much time he spends on journal reading, the place of reading journals and the factors which affect journal reading have also been investigated. Though the findings are almost unanimous that a user can cope up with his field by reading few journals, the average number of journals actually read varied widely. In Menzel's study (Columbia University, 1958, p. 135), three most important journals accounted for 0.49 fraction of articles read by research scientists. Two surveys of Case Institute of Technology (1960, p. 12) showed that ten mostly-read journals accounted for 55.1 per cent and 49.8 per cent of the chemists' journal reading time respectively. Many studies have confirmed that an average scientist/engineer/technologist reads 5 to 15 journals while normally a scientist reads more journals than an engineer or a technologist (Scott, 1959, p. 113; Martyn, 1964, p. 20; Bernal, 1948; Martin, 1962, p. 98; Wood and Hamilton, 1967; Graleswka-Vickery, 1976, p. 274; Hanson, 1964, p. 65; Ford, 1977, p. 32). The use of books and other documents of library have very widely varied from library to library, from subject to subject, and no generalised conclusion except 80/20 rule cited above can be made as far as user behaviour is concerned.

5. CORRELATION OF USE OF LIBRARY COLLECTIONS WITH USER CHARACTERISTICS

The correlation of use of library documents with user characteristics has not always shownconsistent results. Interestingly, a person who saw more journals tended to be active in many ways like attending more meetings and conferences, actively engaged in the work and having better qualifications (Scott, 1959, p. 28).

First of all, the use of library documents is found to vary with the type of organisation and users. Those employed in government establishments and industries have made relatively less use of library (and journals) than those employed in academic and non-profit organisations (Slater and Fisher, 1969, p. 15; Meadows and O'Connor, 1969). The analysis of use of library in science subjects versus engineering/technology is found to be fairly close to that of scientist versus engineer/technologists pattern, i.e., scientists particularly those in research made more use of libraries than engineers and others (Case Institute of

Technology, 1960, p. 21). Surprisingly, the average number of documents consulted by scientists (3.9) was lower than that of engineers, but the ratio of used to useful documents was more favourable for scientists. The pressure of time bothered engineers slightly more than it did scientists, but slightly less than it did non-technical personnel. Technicians were found to be underprivileged group in the information complex (Slater and Fisher, 1969, p. 17, 18 and 50).

The use of library documents (and journals) was found to be linearly and positively related to the age and experience of users as per studies of Scott (1966, p. 28), Lipetz (1970), Fearn and Melton (1969). However, beyond the age of 45 years and 10 years of experience the use was found to decline. But the opposite (i.e., negative relation) was found in studies like that of Bath University Library (1971), Barkey, (1966) and Ford (1977, p. 93). Women space technologists did not differ from men in making borrowed use of library documents but differed significantly in in-house use and interactions with the library (Sridhar, 1987). Again the use of the library was found to be positively related to the level of education of the users (Scott, 1966, p. 16; Lipetz, 1970; Fearn and Melton, 1969).

Creativity, performance, excellence in work and publication activities are also found to be positively related to use of libraries (Lufkin and Miller, 1966, p. 180; Case Institute of Technology, 1960, p. 21). However, a recent study found no strong relationbetweenthe use of libraries and academicperformanceof users (Hiscock, 1986). In addition, high status scientists and engineers tended to use more of library materials and subscribe to more journals (Shaw, 1971, pp. 17-20, and 48, 49) and managers and supervisors, particularly those in research and production areas, tended to read more journals than others (Scott, 1960, p. 28).

6. USER INTERACTIONS WITH LIBRARY

Like 'use of library', user interactions with the library is also a phenomenon of a minority of users. In fact, both the use of library and the user interactions with the library are highly interdependent and related. However, there is not much research work done about user interactions with the library. What is available in literature are fragmentary stray attempts to study some

Interactions of users with libraries. This may be partly due to the time-consuming observation technique to be followed for the purpose. For the same reason many use-studies also did not venture to consider the in-house use of library documents.

A user visits the library for many purposes. Interestingly, Slater and Fisher (1969, p. 29) found that 38 per cent of their respondents visited their libraries for work space (11 per cent exclusively for work space). Even in the study of Science Library at MIT (Bush, et al., 1956, p. 88) a considerable number of persons used the library only as a study hall to make use of their own material. On the contrary, Scott (1959, p. 113) found that 59 per cent of the respondents claimed to do most of their journal reading at home followed by 27 per cent at place of work, 2 per cent during journey on train, 3 per cent in a library, 1 per cent in other places and 2 per cent of the respondents did no reading of technical journals. In a study of in-house use of library documents and seat occupancy, the space technologists were found to visit the library more during departmental reviews for promotion. The distribution of user-visit data over a typical day was bimodal, roughly symmetric and the same was cyclical over a typical week with maximum during the mid of a working week (Sridhar, 1982). Like use of library documents, the reservations made by the space technologists for lentout documents followed skewed distribution and year of acquisition of a document had a stronger effect on its chances of getting more reservations than year of publication (Sridhar, 1983). In another study, it was found that less than one-fourth of the space technologists nave had participated in collection development of the library (Sridhar, 1983). Yet another case study showed non-use of classified catalogue, heavy use of subject catalogue and a roughly symmetric bimodal distribution of card catalogue consultation over a typical day by the space technologists. Further, card catalogues are consulted most of the time either to locate a document on the shelf or to interact with the circulation counter than for literature search (Sridhar, 1986). A rational summary of enormous data of use of the library collection and interactions with the library by Indian space technologists is done by way of developing suitable indexes of library use and user interactions with library (Sridhar, 1988).

There are no comparable results of earlier

research about specific aspects of user behaviour within library as far as scientists, engineers and technicians are concerned. Most of the findings of user movement/traffic, consultation of card catalogue, in-house use, length of stay, seat occupancy, etc., are that of academic or public library users. Apart from science library at MIT mentioned above, Pings and Anderson's (1965) study of user movement/flow pattern, the study made by the University of Cambridge Library Management Research Unit (1975) about seat occupancy, and Campbell and Shlechter's (1979) study of library design influences on user behaviour are some of the studies in this direction.

7. CONCLUSION

It was not the intention of this paper to examine studies of use of library collections by scientists, engineers and technicians from the angle of (i) collection development and evaluation with the purposes of identifying highly used to add additional copies, less used to relegate to remote/compact storage and unused for discarding, (ii) promoting better usage of less used and unused, (iii) examining the broad generalisations such as (a) books which are unused during an initial period are more likely to remain unused and those heavily used continue to be used later, and (b) use data of a library collection follows reverse J-shaped curve or 80/20 rule, and (iv) determining life time and obsolescence rate of library materials, relative use in different subjects, etc. The purpose here is to look at the use-studies from the angle of information use pattern of scientists, engineers and technicians. As such many studies like that of University of Pittsburgh (Kent, et al., 1979) are not cited here.

Like bibliometric and citation studies, use-studies also have some limitations. If use-study is not properly designed with adequate reliability and validity, results can cause serious distortions and lead to disastrous decisions.

The research on use of library collections by scientists, engineers and technicians has fairly helped in better understanding of their patterns of information use though there are some

inconsistencies and contradictions. The review of use-and user-studies clearly indicated the void in nature of user-research in the country. User-studies have been neglected both at local and national level by planners of S&T information systems. The piecemeal studies have been mostly local studies of a particular aspect of user behaviour or indirect use-studies or studies based on weak methodology and data. The majority of even the piecemeal studies are done by academicians and students. Unless sufficient baseline studies are done within the country by the information personnel 'living with the tribe', further developments cannot be carried out based only on the findings of studies done in USA or UK.

REFERENCES

1. Ackoff,Russell L. *et al*. Designing a National Scientific and Technological Communication System (The SCATT Report). (University of Pennsylvania Press, Pennsylvania), 1976.

2. Allen, Thomas J. Communications in a research and development laboratory. *Technology Review*, 69 (1967).

3. Allen, Thomas J. and P.G. Gerstberger. Criteria for Selection of an Information Source. MIT-284-67.(MIT, Alfred P. Solan School of Management, Cambridge), 1967.

4. Atherton, Pauline. Research in information science: an assessment. *In* Perspectives in Information Science, A. Debons and W.J. Cameron, (Eds). (Noordhoff, Leyden), 1975, pp. 665-679.

5. Atherton, Pauline. Handbook for Information Systems and Services. (Unesco, Paris), 1977.

6. Bernal, J.D. Preliminary analysis of pilot questionnaire on the use of scientific literature.*In* Report of the Royal Society Scientific Information Conference, 21 June-2 July 1948.(Royal Society, London), 1948, pp. 589-637.

7. Brittain, J. Michael. Information and its Users--A Review with Special Reference to Social Sciences.(Wiley Interscience, New York), 1971.

8. Brittain, J. User Studies in Education and the Feasibility of an International Survey of Information Needs in Education. (Bath University, Bath), 1971.

9. Brittain, J. Information needs and applications of results of user studies.*In* Perspectives in Information Science, Anthony Debons and Williams J. Cameron, (Eds). (Noordhoff, Leyden), 1975, pp. 425-447.

10. Bush,G.C.*et al.*, Attendence and use of science library at MIT. American Documentation, 7(2),(1956), 87-109.

11. Campbell, Devid E. and Shlechter, Theodore M. Library design influences on user behaviour and satisfaction. *Library Quarterly* 49(1),(1979), 26-41.

12. Case Institute of Technology, Operations Research Group. Study of the Dissemination and use of Recorded Scientific Information: Pt. I--Journal Reading by Physicists and Chemists; Pt. II--Cost of Journal Publication; Pt. III--Effect of Coŋdenstation on Comprehension of Journal Articles. (Case Institute of Technology, Cleveland), 1960.

13. Columbia University, Bureau of Applied Social Research. Flow of Information among Scientists: Problems, Opportunities and Research Questions, (study Director: Herbert Menzel). (Columbia University, BASR, New York), 1958.

14. Cooper, William S. Why bother theory of information usage? *Journal of Informatics* 2(1),(1978), 2-5.

15. Fearn, Robin A.C. and Melton, Jessica S. Information centre user study. *In* Proceedings of the 32nd Annual Meeting of ASIS, San Francisco, 1-4 October 1969, Jeanne B. North (Ed). (Greenwood Publishers, Westport), 1969, pp. 463-470.

16. Ford,Geoffrey, (Ed). User Studies: An Introductory Guide and Select Bibliography; CRUS Occasional Paper 1. (University of Sheffield, CRUS, Sheffield), 1977.

17. Ford, N. Relating Information needs to learners characteristics in higher education. *Journal of Documentation*, 36(2),(1980), 99-114.

18. Frohman, Alan. Determinants of Library Use in

an Industrial Firm. Term Paper. (MIT, Alfred P. Sloan School of Management, Cambridge), 1969.

19. Gralewska-Vickery, A. Communication and Information needs of earth science engineers. *Information Processing and Management*, 12(4),(1976), 251-282.

20. Hanson, C.W. Research on users' needs: where it is getting us? *Aslib Proceedings*, 16(2),(1964), 64-78.

21. Havelock, Ronald G. *et al*. Planning for Innovation Through Dissemination and Utilization of Knowledge. (The University of Michigan, The Institute for Social Research, CRUS, Michigan), 1969.

22. Hiscock, Jane E. Does library usage affect academic performance? A study of the relationship between academic performance and usage of libraries at the Underdale site of the South Australian College of Advanced Education. *Australian Academic and Research Libraries*, 17(4),(1986), 207-214.

23. Hoadley, Irene Braden and Clark, Alice S. (Eds). Quantitative Methods in Librarianship: Standards, Research, Management. *In*Proceedings and Papers of an Institute held at the Ohio State University, 3-16 August 1969. Contributions in Librarianship and Information Science. No. 4. (Greenwood Press, Connecticut), 1972. •

24. Kent, Allen *et al*. Use of Library Materials: The University of Pittsburgh Study. (Marcel Dekker, New York), 1979.

25. Kochen, Manfred. What makes a citizen information system used and useful. *In* Information for the Community, Manfred Kochen and Joseph C. Donhue, (Eds). (ALA, Chicago), 1976, Chapter 10, pp. 149-170.

26. Krikelas, James. Information-seeking behaviour: patterns and concepts. *Drexel Library Quarterly*, 19(2),(1983), 5-20.

27. Kunz, Werner *et al*. Methods of Analysis and Evaluation of Information Needs: A Critical Review. (Verlag Dokumentation, Munchen), 1977.

28. Landau, Robert *et al*.(Working Group V).User needs.*In* Perspectives in Information Science,

Anthony Debons and William J. Cameron, (Eds). (Noordhoff, Leyden), 1975.

29. Line, Maurice B. Fortyseventh Aslib Annual Conference summing up: the information service in practice. *Aslib Proceedings*, 26(1),(1974), 47-53.

30. Line, Maurice B. Draft definitions: Information and library needs, wants, demands and uses. *Aslib Proceedings* 26(2),(1974), 87.

31. Lipetz, Ben-Ami. Information needs and uses. *In* Annual Review of Information Science and Technology, Carlos A. Cuadra (Ed). Vol. 5. (John Wiley, New York), 1970, pp. 3-32.

32. Lufkin, J.M. and Miller, E.H. Reading habits of engineers: a preliminary survey. *IEEE Transactions on Education*, E-9(4),(1966), 179-182.

33. Martin, Miles W. Use of random alarm devices in studying scientists reading behaviour. *IRE Transactions on Engineering Management* 9(2),(1962), 66-71.

34. Martyn, John. Report of Investigation of Literature Searching by Research Scientists. (Aslib. London), 1964.

35. Mick, Colin K. Human factors in information work. *In* Communication Information: Proceedings of ASIS 1980 Meeting, Ananheim, California, 5-10 October 1980, Alan R. Benenfield and Edward John Kazlauskas, (Eds). (ASIS, New York), 1980, pp. 21-23.

36. Meadows, A.J. and O'Connor, J.G. Investigation of Information Sources and Information Retrieval in Astronomy and Space Sciences. OSTI 5044.(University of Leicester, Astronomy Department, Leicester), 1969.

37. Moor, William Chattle. Development and preliminary test of behaviour related dimensions of information systems. *Journal of the American Society for Information Science*, 23(1),(1972), 50-57.

38. Mooers, Calvin N. Mooer's law or why some retrieval systems are used and others are not. *American Documentation*, 11(3),(1960), il.

39. Myers, J.M. Information as a saleable commodity. *In* Accelerating Innovation: Papers given at a Symposium held at the University of Notingham, March 1969. Organised by Aslib, and UK Ministry of Technology and Research Associations.(Aslib, London), 1970, pp. 26-29.

40. Oldman, Christine.Value of Information, Library Research Occasional Paper No. 1. (MCB Publications, Bradford), 1976.

41. Paisley, William J. Information needs and uses.*In* Annual Review of Information Science and Technology, Carlos A. Cuadra (Ed). Vol. 3. (John Wiley, New York), 1968, pp. 1-30.

42. Pings, Vern M. and Anderson, Fanny. Study of the Use of Wayne State University Medical Library, Pt. 1.(Wayne State University, School of Medicine Library and Biomedical Information Service Centre, Detroit), 1965.

43. Rosenberg, Victor. Application of Psychometric Techniques to determine the Attitudes of Individuals toward Information Seeking. MS Thesis; AD 637 713; AFOSR 724-66. Lehigh University, Bethlehem, 1966.

44. Scott, Christopher. Science of science: what scientists read and why? *Discovery,* 20(3), (1959) 110-114.

45. Scott, Christopher. Use of technical literature by industrial technologists.*In* Proceedings of the International Conference on Scientific Information, Washington, D.C., 16-21 November 1958. (National Academy of Sciences, National Research Council, Washington, D.C.), 1959, pp. 245-266 (preprints pp. 235-256).

46. Scott, Christopher. Use of Technical Literature by Industrial Technologists: A Study of Technical Information in the Electrical Industry 1957-58 (survey designed by Leslie T. Williams). The Social Survey Report No. 245. (The Social Survey, London), 1960.

47. Shaw, Ralph R. Pilot Study of the Use of Scientific Literature by Scientists. (NSF/Scarecrow Reprint Corporation, Washington, D.C./Metuchen), 1956/1971.

48. Shuchman, Hedvah L. Information Transfer in Engineering. Rep-461-46-27. (Futures Group Inc., Connecticut), 1981.

49. Slater,Margaret and Fisher, P. Use Made of Technical Libraries, Aslib Occasional Publication No. 2. (Aslib, London), 1969.

50. Sridhar, M.S. Study of library visits and in-house use of library documents by Indian space technologists. *Journal of Library and Information Science,* 7(2),(1982), 146-158.

51. Sridhar, M.S. User participation in collection building in a special library: a case study. *IASLIC Bulletin,* 28(3),(1983), 99-106.

52. Sridhar, M.S. Document reservation patterns in a special Library: a case study. *Library Science with a Slant to Documentation,* 20 (1),(1983), 39-48.

53. Sridhar, M.S. Case study of lentout use of a special library. *Library Science with a Slant to Documentation,* 22(1),(1985), 19-34.

54. Sridhar, M.S. Pattern of card catalogue consultation in a special library. *IASLIC Bulletin* 31(1),(1986), 9-16.

55. Sridhar, M.S. Study of Information Seeking Behaviour of Space Technologists with Emphasis on Correlating User Characteristics with Information Behaviour, PhD Thesis. University of Mysore, Mysore, 1987.

56. Sridhar, M.S. Information and communication behaviour of women space technology *Management,* 17(4),(1987), 301-309.

57. Sridhar, M.S. Library-use index interaction index as measures of effectiveness special library: a case study. *In* Proceedings XXXIV All India Library Conference on Information Services : Assessment of Effectiveness. (ILA, Calcutta), 1988, pp.

About the Author

Dr. M. S. Sridhar is a post graduate in mathematics and business management and a doctorate in library and information science. He is in the profession for last 35 years. Since 1978 he is heading the Library and Documentation Division of ISRO Satellite Centre, Bangalore. Earlier he has worked in the libraries of National Aeronautical Laboratory (Bangalore), Indian Institute of Management (Bangalore) and University of Mysore. Dr. Sridhar has published four books ('User research: a review of information-behaviour studies in science and technology', 'Problems of collection development in special libraries', 'Information behaviour of scientists and engineers' and 'Use and user research with twenty case studies') and 74 research papers, written 19 course material for BLIS and MLIS, presented over 22 papers in conferences and seminars, and contributed 5 chapters to books. **E-mail:** sridharmirle@yahoo.com, mirlesridhar@gmail.com, sridhar@isac.gov.in ; **Phone:** 91-80-25084451; **Fax:** 91-80-25084475.