FROM COLLECTIONS TO ACCESS

A Policy Research Report

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NATURAL RESOURCES ENERGY & SCIENCE AUTHORITY OF SRI LANKA

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Technological and Institutional Choices for the Sri Lankan Scientific and Technological Information System in a Rapidly Changing Environment

A Policy Research Report
by

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Contents

Executive Summary

This report examines the Sri Lankan scientific and technological information (STI) system as a communication network, with emphasis on the mechanisms for the acquisition of information on information, principally abstracting and indexing services in print form, and the modes of domestic and foreign document delivery. The problems of non/under utilization of STI resources, the shortcomings of the cooperative acquisition strategy for abstracting and indexing journals, and the phenomenon of library bypass are discussed.

The technical and economic features of three information and communication technologies, new to the Sri Lankan STI system, are investigated in relation to the specificities of the system. The characteristics, as well as the prevalent usage in Sri Lanka, of microform are found to be biased towards storage and preservation, and not conducive to the increased access. Market developments in optical disks (CD-ROMs) are interpreted as indicating continued price and product volatility, among other things. The advantages of automated searching capability independent of telecommunications and lower costs for high usage databases are weighed against the disadvantages of fixed pricing, uncertainty, and the collections bias of the medium. Online, despite the crucial constraint of an expensive and low-quality telecommunication network, is found to offer the most in terms of providing access to STI, particularly for a country with a "thin-layer" of researchers.

A computerized selective dissemination of information (SDI) service and an online bureau service provided by an information access centre is proposed as the cornerstone of an offensive strategy to transform the STI system from its role as a brake on research activity to an effective policy tool for increasing scientific productivity. The central SDI function is integrated with educational, network building, and telecommunications enhancing activities in a phased programme that will see the flexible and intelligent utilization of a mix of technologies to move towards an effective and catalytic STI system. Institutional structures to maintain and enhance flexibility and innovativeness are suggested. Approaches to the problems of local and foreign data communication, including a pilot project between two or more STI centres, are discussed.

Acknowledgements

This study was done in two and a half months, but represents the fruit of two years of research on the Sri Lankan scientific and technological information (STI) system and the potential applications of new information and communication technologies therein. Many debts have been accumulated on the way. This report is part repayment.

The UNISIST Working Committee of the Natural Resources, Energy and Science Authority of Sri Lanka (NARESA), by approving the unusual proposal submitted for this project, made this particular study possible. I am grateful to NARESA for sponsoring a project I had wanted to do for a long time, and to the International Development Research Centre for funding it.

Mr Upali Yapa, Director - Information, NARESA, introduced me to the intricacies of the Sri Lankan STI system on 01 November 1985, the very first day I commenced work on scientific communication. I am grateful for the contribution he has made to my thinking on the subject, for providing research data, and for the administrative support without which the project could not have been completed. Mr Clive Wing, Program Officer, Information Sciences Division, IDRC South Asia Regional Office, New Delhi, not only kept my interest in the subject from flagging but went beyond the call of duty in performing an informal document delivery function. To him, and to Ms Susanne Mowat, Program Officer, Social Sciences Division, IDRC, New Delhi, I am thankful. My former colleagues at the Arthur C. Clarke Centre for Modern Technologies, Mr Nihal Kularatne and Mr Shantha Fernando (Research and Development Engineers), assisted me on technical matters. The contribution of Professor Cyril Ponnamperuma, Director, Institute of Fundamental Studies Sri Lanka, who started me off on this investigation is gratefully acknowledged.

Many librarians throughout the country contributed to this study. For their kindness in consenting to be interviewed and in providing the requested data, I am most indebted. The Sri Lanka Scientific and Technical Information Network and the Sri Lanka Library Association provided collegial fora for the exchange of ideas. I also wish to acknowledge with thanks the assistance given by many members of the STI user community who tolerated my persistent questioning in many formal and informal settings. My wife, Dr Sujatha Gamage of the Department of Chemistry, University of Colombo, helped in many ways including the preparation of the price trends data.

FROM COLLECTIONS TO ACCESS: TECHNOLOGICAL AND INSTITUTIONAL CHOICES FOR THE SRI LANKAN STI SYSTEM IN A RAPIDLY CHANGING ENVIRONMENT

1. INTRODUCTION

The present period is one marked by rapid change in the manner in which information is created, stored, retrieved, and transmitted. The basic thrust has been provided by investments and technical breakthroughs in the computer and communication industries. Subsequently, there have been significant investments in the information content industries too. The catchwords, "information society" and "information revolution", symbolize the manner in which the role of information is currently perceived: pervasiveness and rapid change.[1]

Rapid change is destablilizing. Different elements of a system are affected differentially by change. Uncertainty increases. Again, its distribution is uneven across the system. Elements of the system generating the change process are affected by uncertainty but are in a position to diversify their risks. Those in the periphery of the system are not so fortunate and bear the brunt of the uncertainty.[2] High uncertainty is not necessarily a bleak condition. There are far more choices to be made, but the outcome is not preordained. There is danger, but there is also opportunity.

The Sri Lankan scientific and technological information (STI)[3] system is a peripheral element of the worldwide STI system. This is a consequence of the country's politico-economic relationships and the

nature of Sri Lankan science.[4] The peripheral status of the Sri Lankan STI system is manifested principally in the wholesale importation of STI content, services and distributional equipment, with almost no exportation, and the relative unimportance of locally generated STI. It may be argued that this is unexceptional, given Sri Lanka s position as a peripheral element of the world system. However, the component elements of the national system of organized textual information are not uniformly dependent. Some, like the legal information system, display very little dependency, giving pride of place to internally generated information. In contrast, scientific research and STI are extremely dependent. However, there is variation within the STI system itself, with certain fields such as agriculture and health giving relatively more emphasis to internally generated STI.

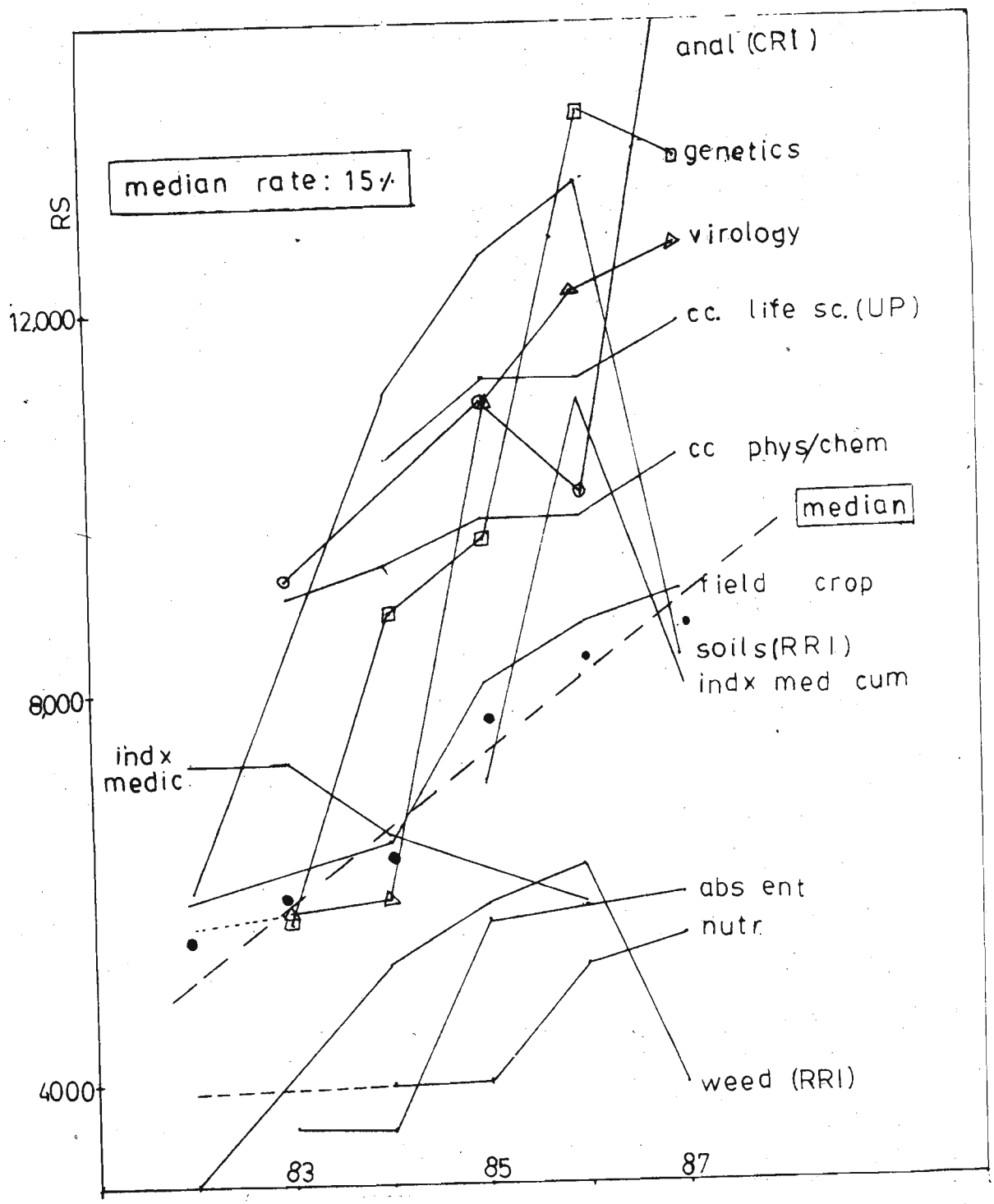
The Sri Lankan STI system has been in crisis for a couple of decades. This has been partly a consequence of the overall politico-economic crisis. The "lost years" of 1974-75 in almost all the foreign periodicals holdings in the country's libraries testify to the impact of the larger crisis. The sudden increase in world food and fuel prices in 1972-73 led to a shortage of foreign exchange. The then government s response included the total elimination of foreign purchases by universities and a number of other institutes. The STI system is also affected by the malaise that has enveloped the universities and the research institutes. As working conditions and morale of scientific personnel have deteriorated, there has been a concomitant deterioration of conditions in STI institutions. When scientists turn away from research and universities are more closed

than open, it is only natural that ennui would begin to settle over the desolate libraries.

There are those who argue that these larger societal factors fully account for the crisis in the STI system and that it may be overcome only by action at the politico-economic and science policy levels. This study does not share that view. The STI system suffers from problems of its own, over and above the impact of the larger crises. By addressing the problems specific to the STI system it may even be possible to indirectly attack and alleviate some of the larger science policy problems.

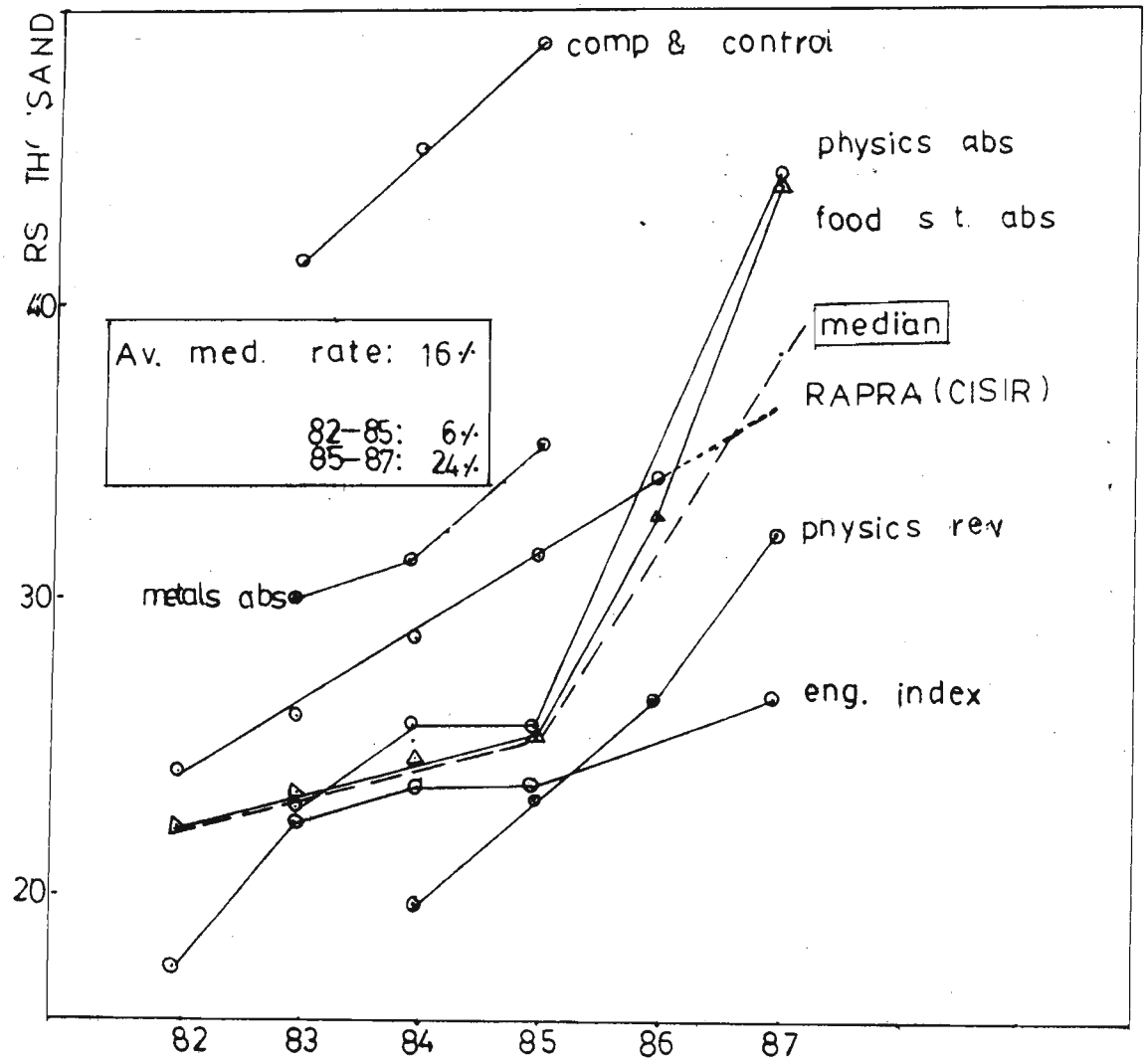
What are the problems specific to the STI system? The basic problem is the high uncertainty generated by the rapid changes in the world STI system. This is manifested in a number of ways: erratically escalating prices of print periodicals; technological "fixes" that move in and out of fashion very quickly; and rapidly changing user expectations. The expansion of STI content and services is accompanied by contraction of the real purchasing power of libraries, a phenomenon common to developed as well as developing countries:

> Inflation in book and journal prices has far outpaced the annual increases in library book and journal budgets. U.S. periodical prices have quadrupled and hardcover book prices have tripled. The price of scholarly books and journals continues to rise at an average rate of 15 percent a year. Association of Research Libraries (ARL) statistics show a decline of 3 percent a year in the number of volumes added by its members in recent years. Meanwhile, the number of books and journals published in the United States and abroad continues to increase at record rates. Libraries are spending more every year to buy an ever-decreasing percentage of the rapidly growing output of the world's publishers.[5]



Source: Appendix I

FIGURE 1a. Price Trends: Selected A&I Journals
(Rs 0-15,000 / Year)



Source: Appendix I

FIGURE 1b. Price Trends: Selected A&I Journals
(Rs 15,000-50,000 / Year)

However, the effects are generally harsher in the developing countries where exchange rates are slipping vis-a-vis the US dollar and the other powerful currencies. Analysis of price trends of selected abstracting and indexing journals subscribed to by Sri Lankan STI libraries indicates that prices have been rising quite steeply, with a median increase in the range of 15-20 percent relative to the base year of 1982. The period for which the data was gathered does not include 1977, the year of a major devaluation of the Sri Lankan currency (approximately 50 per cent in relation to the US dollar). Figure 1 illustrates the price behaviour of the journals, not only the general increase but also the erratic nature of the increases and occasional decreases. Agent markups, currency movements, negotiating ability and many other factors are involved in the determination of the prices paid by local libraries. A policy recommendation that flows out of the findings on journal prices is that SLSTIC systematically gather and disseminate timely information on list prices as well as prices being negotiated with agents in order to increase the negotiating power of individual libraries.

In addition, there is an inherent problem in the structure of scientific research in Sri Lanka, described as the "thin layer problem" or as the "small system syndrome".[6] The scientific community in Sri Lanka may be described as a "thin layer". The number of scientists is small, compared to developed countries. However, almost all the areas of science are covered, with the result that there are very few scientists in each area. This makes it very difficult and costly to supply the information requirements of all scientists adequately. Generally, less scientists will be utilizing a particular

journal than would be the case in a developed country. As the costs of print journals are independent of usage, the per-user costs are very high. Schwartz has located the problem at the institutional level too:

> . . . there is the tendency of fragmentation of resources into nonviable or barely viable units with unclear objectives and the ambition to replicate (in miniature scale) the whole spectrum of organizations, associations, and activities that can function autonomously only on a larger scale.[7]

The final major problem is the underdeveloped communication infrastructure. The internal telephone network is overloaded and unreliable.[8] The pent up demand for plain voice telephone service is so high--46,000 registered waiters on a subscriber base of 84,000[9]--that it is unlikely that the department will provide adequate facilities for data communication or even telex within the next few years.[10] There is no data communication service between Sri Lanka and any external point, though voice lines may be used for data transfer at the low 300 baud speed. The postal and telegraphic services are relatively more reliable but are still poor substitutes for an efficient telecommunication-based text transmission system. Institutional rigidities also constitute barriers to the efficient networking of STI institutions that may serve to alleviate the thin layer problem.

This is the context within which the new information storage and distribution technologies of microform, online and CD-ROM must be evaluated. The principal task is that of understanding the nature and specific problems of the Sri Lankan STI system. Here, the STI system is considered principally as a communication system. The

characteristics of the new technologies are examined in relation to the needs of the Sri Lankan STI system.

Data on the Sri Lankan STI system was gathered through interviews with selected librarians (Appendix V), records of the external transactions of libraries, and a standard questionnaire (Appendix IV) circulated to all member libraries of the Sri Lanka Scientific and Technical Information Network (SLSTINET) (Appendix III). A limited number of interviews with heavy users were conducted. Attention was paid to both the formal and informal aspects of the STI system. Formal transactions such as inter-library loan requests are reflected in (some) library records. But the picture will not be complete unless informal transactions between researchers, and even certain types of informal library-to-library communications are taken into account.

Data on the new technologies was obtained by the use of new technologies and by old methods. A number of online searches were done through the online bureau service of the Sri Lankan Business Development Centre (SLBDC). References obtained through the online searches as well as those obtained by conventional means were used to order documents by mail from the British Library Document Supply Centre (BLDSC). Information gathered over the past one and a half years in the course of a related project, as well as information from interviews and demonstrations in London and other cities were utilized. Recourse was also made to informal methods of information collection such as directly obtaining information from knowledgeable persons outside the country.

2. THE SRI LANKAN STI SYSTEM

Background

The history of STI in Sri Lanka, in the commonly understood sense, goes back to the establishment of the botanical gardens in the early part of the nineteenth century. However, the portion of that history relevant to the present study begins in 1968. The two landmark events were the establishment of the National Science Council (renamed Natural Resources, Energy and Science Authority [NARESA] in 1982) and the consultancy mission by a Unesco expert on the setting up of a national scientific and technical documentation centre.[11] The two events, taken together, may be interpreted as signifying a commitment to the utilization of STI as a policy instrument for the general enhancement of the country's scientific and technological capabilities. The Samarasinghe Report called for the coordination of existing, inadequate resources and the provision of services such as union lists and bibliographies.[12] Though the terms "network" and "system" were not used as such, it is clear that the report implicitly recommended the integration of the hitherto isolated Sri Lankan STI institutions into a network, with the proposed documentation centre as the node. This is evident, among other things, from the recommendation that the proposed centre be "the sole organ through which requests for documents are sent abroad."[13]

The recommendations of the 1968 consultancy mission were not implemented until 1977, due to the low priority assigned to the project by successive governments. During the interim period, the question of the host institution for the proposed documentation

centre was resolved in favour of the National Science Council. In 1977, a revised project document was submitted to UNDP and the agreement for a four-year project (later extended to five) signed. The project was for the sum of USD 400,000 and the executing agency was Unesco.[14] The existing NSC Documentation and Information Division was expanded and renamed the Sri Lanka Scientific and Technical Information Centre (SLSTIC) in 1978. The bulk of the budget (USD 300,000) was spent on equipment for SLSTIC (microform, printing, audio-visual, photocopying and computer equipment), as well as for other STI libraries (7 photocopiers). All the SLSTIC staff members were sent for foreign training.[15] Two consultancy missions were part of the project.[16] Work on the union catalogues, UNICAST (foreign books) and UNILIST (periodicals), commenced in 1977. The idea of establishing an STI network was formally mooted at a meeting of directors of S&T institutions in 1977. Work on rationalizing the purchase of S&T abstracting and indexing journals through a cooperative acquisitions plan [CAP(A&I)] commenced in 1978. The first version of UNILIST (two volumes) was produced in 1979.[17]

By 1979 there were 23 libraries in the SLSTINET network. NARESA, or SLSTIC, took the initiative in forming AGRINET, the specialized network for agricultural information. The World Health Organization (WHO) formed the specialized health information network, HeLLIS. Both function as subnetworks of SLSTINET. The third subnetwork is RERINET (renewable energy) which was also formed by NARESA. A fourth network, APINMAP (medicinal and aromatic plants) is in the process of formation.

SLSTINET has its own (irregular) newsletter, SLSTINET Newsletter, and organizes periodic meetings of member librarians. Membership and participation is voluntary. It does not have dedicated funds, though the costs of network maintenance are borne by NARESA through SLSTIC. Of the subnetworks, only HeLLIS has a formal administration structure and a budget. The Deputy Director General of Health coordinates the network, which has a designated focal point for international transactions. A regular newsletter and monthly meetings are used for network maintenance. Due to the relatively well developed state of agricultural research in the country, AGRINET has become an active network. The programme for the selective dissemination of contents pages among member libraries is a unique achievement of AGRINET. RERINET, which was perhaps created principally to provide access to the large collection of microfiches donated to SLISTIC by the Energy Information Services of CSIRO [Commonwealth Scientific and Industrial Research Organization of Australia], has been somewhat slow off the mark.[18]

The System

The STI system exists to serve the user. The primary user of the Sri Lankan system is the research scientist. Certain components of the system like the Industrial Development Board's Industrial Information Service serve other categories such as development workers and industrialists, and most STI centres also serve educational users. However, in almost all cases, the most advanced components of the libraries are there more or less exclusively for the research users. If good research is a policy objective (this study takes that as an assumption), researchers must be provided with the most current and

comprehensive information. Periodicals and abstracting and indexing services are provided principally for, and used most heavily by, this group. They require extensive coverage of the literature, i.e., retrospective searches on particular topics, and current awareness. Thus it is justifiable to take the research-support function as the central activity and the others as subsidiary functions.

The research user requires information on information. He/she may obtain it by informal methods such as personal contacts and conferences. These methods have positive features such as a very high degree of relevancy and contextual setting, and can never be fully replaced.[19] However, in today's conditions of massive information production, rapid movement of research fronts and interdisciplinarity, proper utilization of S&T information must be based on the systematic use of information on information. It is the library's responsibility to provide the most comprehensive and timely information on information in the format or formats most convenient to the user.

The principal sources of information on information in the Sri Lankan STI system are abstracting and indexing (A&I) services in print form delivered by post. A very few libraries (Central Library of the Department of Agriculture and the Ceylon Institute for Scientific and Industrial Research) receive A&I journals in microform by mail. Librarians and users utilize A&I journals to carry out literature surveys at the commencement of projects and to keep abreast of developments pertinent to current research. The importance given A&I journals by a research-oriented STI library is shown by the following

figures pertaining to the Ceylon Institute for Scientific and Industrial Research (CISIR):

Periodicals Expenditures -- CISIR, 1986

	Rs.
Books & periodicals budget	1,096,555 -- (i)
Foreign periodicals budget	759,260 -- (ii)
A&I periodicals budget*	480,101 -- (iii)
(iii) as percentage of (i)	43.8%
(iii) as percentage of (ii)	63.2%

* Does not include the 11 (out of 24) A&I journals that are obtained as gifts or on exchange.

Source: Computed from data supplied by CISIR to NARESA, 21/08/1987; and to Investigator, 20/08/1987.

TABLE 1

The above figures also illustrate how costly A&I journals can be. The single most expensive journal subscription in Sri Lanka amounting to Rs 324,000 per year (the complete Chemical Abstracts) skews the figures somewhat, but the average annual cost of a purchased A&I journal at the CISIR in 1986 amounted to Rs 36,931. It is not possible to present data covering a representative sample of STI institutions because budgetary disaggregation of A&I journals from primary journals is not commonly done in Sri Lankan libraries.[20] Price data on A&I journals received in Sri Lanka, for which prices over the past few years are available, are given in Appendix I.

The role of A&I journals vis-a-vis primary journals in Third World countries is different from that found in the affluent countries. They tend to be used as substitutes for primary journals in the former case, as opposed to the complementary role found in the

latter.[21] It has also been suggested that due to the relative unavailability of A&I journals in Sri Lanka, they may be used less for current awareness and more for retrospective searches here.[22] Recognition of the vital importance of A&I journals and their increasing costliness has led to activity centred around a cooperative acquisitions plan for A&I journals by SLSTINET since 1978. The objective is to:

> maximise the use of funds by avoiding unnecessary duplication by two libraries in the same vicinity purchasing the same title. Money saved by circumventing duplication could be used to purchase a new title. CAP(A&I) ensures that the most important abstracting and indexing services be available at a library in Sri Lanka.[23]

After nine years, CAP(A&I) does not seem to have made much impact. It has influenced librarians in their decisions regarding the dropping of titles, but has never been the main factor. Titles have been dropped, not in order to release funds for new, rationalized acquisitions, but in response to budget contraction and/or price increases. Librarians appear to have balked at losing control over a vital library function, as have users at the prospect of increased inconvenience in accessing information. The principal weakness of the CAP(A&I) strategy of responding to the budget crunch is the absence of a simple and efficient access mechanism to the A&I journals not subscribed to, or ceded to another library under CAP(A&I), by a user's library. Possible remedies within the CAP framework would be the "bicycling"[24] around of A&I journals between designated libraries (which in itself may increase usage due to the rationing effect[25]); the provision of transport and other facilities to encourage visits to other libraries; and the establishment of reciprocal borrowing

rights agreements to make such visits more attractive to users. Where a library has a narrow, well-defined focus and regularly provides SDI [selective dissemination of information] services, the library staff may visit the sites of the ceded A&I journals and extract information on behalf of the users. This is currently done by the Coconut Research Institute library. A documentalist visits the CISIR library in Colombo once every month to extract the coconut-related references from Chemical Abstracts.[26]

In addition to generalized access to A&I journals, researchers may utilize formal literature searches, as well as SDI and current awareness (CA) services as sources of information on information. A number of research institute libraries have been offering manual search services for many years. Here, the documentalist usually searches the inhouse material based on a search specification provided by the user. Over the past few years, some Sri Lankan researchers have been able to benefit from free offline computer searches. Offline searches of Medline/Medlars are currently provided by the WHO to biomedical researchers who apply through HeLLIS member libraries through the national focal point to the WHO South East Asian Regional Office in New Delhi, which then passes on the search request to Europe. AGRIS offers searches through the Central Library of the Department of Agriculture to AGRINET users. An earlier facility for general searching provided by the National Library of Australia through SLSTIC has been terminated since 1986. This facility had been used by around 6-7 researchers per year.[27] CISIR continues to utilize offline facilities in Australia. Fifteen free searches had been completed in 1986 through the National Library of

Australia and CSIRO, Australia.[28] The AGRIS searches were limited to a total of 30 per year in 1987. The limit was reached by June 1987.[29] Even the HeLLIS facility had been temporarily stopped in 1986.[30]

Medline Search Requests 1985

Library	Requests	Completions*
Univ Peradeniya/Med	12	07
Univ Colombo/Med	05	02
Univ Jaffna/Med	03	--
Univ Ruhuna/Med	08	02
Med Res Inst	01	--
Nat Inst Health Sci	01	--

* Completion may not be recorded at focal point when search has been sent directly to requestor.

Source: Korale, "Resource Sharing."

TABLE 2

Offline searches have a turnaround time of about 3 months. Almost all interviewed librarians stated that this was not a problem and that there were no user complaints. However, a regional user survey of the HeLLIS network suggests that delay is a problem to users.[31]

Half the SLSTINET libraries responding to the questionnaire (51.7%) appear to be providing SDI services, though there is considerable variation in the level of sophistication. The main research institutes (CISIR, CRI, RRI, etc.) and at least one university library, maintain research profiles and provide advanced manual SDI services based on individual articles in periodicals and monographs added to their holdings.[32] Material not owned by the library is not included, with the possible exception of the CRI library, which doubles as an international information centre. No library has made

arrangements with a foreign database vendor or library to run periodic computerized SDI searches, again with the sole exception of CRI which obtains a monthly SDI update on coconut from AGRIS. It was not possible to obtain any quantitative evidence of the effectiveness of internal SDI services in the form of increased visits or demand for photocopies as such records were unavailable. However, there was consensus among the interviewed librarians that usage had increased and that the users had benefitted.

Dissemination of contents pages, selective and otherwise, is a related information service that has gained popularity amongst Sri Lankan STI librarians. Sixty two per cent of the librarians responding to the questionnaire supplied some form of contents page dissemination. AGRINET's programme of selective dissemination of contents pages of periodicals is the most extensive one of the kind. Distribution is determined by a list of profiles of 290 agricultural researchers compiled in 1983, and scheduled for updating in 1987. Various libraries are assigned specific titles from a total of 330 unique journal titles from which they must send copies of contents pages to the nodal point at SLSTIC.[33] The end result is a sheaf of profile-matched contents pages of journals not available at the home library that arrives at the desks of the listed researchers every month. Though the selectivity is not very fine (what is matched with the research profile is the journal, not the article), the scheme is basically innovative, practical, and mindful of the time and convenience of the user. The information on information provided by the selective contents pages dissemination programme is of journal articles available in Sri Lanka but unavailable at the recipient's

home library. The yield from the programme must be a general increase in domestic interlibrary loan (ILL) activity, and possibly an upward spike in domestic ILL demand immediately following the distribution of the contents pages. Such effects had not been noted by any of the librarians interviewed in the course of this study.

Non-selective contents page dissemination programmes are in effect in a number of STI libraries, especially in the universities. Here, the library prepares a compilation of current contents pages and sends them to sectional heads.[34] It appears that the manpower ratios in university libraries make it difficult to operate a more selective dissemination programme. The basic weaknesses of contents page dissemination schemes such as inconvenience of access both at the time of receipt and over time, greater amount of reading expected of users (the contents page compilation issued by the University of Moratuwa is a couple of inches thick), are overlaid by factors such as delay in passage through sectional heads' offices. However, the lack of selectivity and the resultant increase in size are said to have some benefits. Selectivity at the level of journal, as against article, is a crude technique, especially in relation to interdisciplinary or multidisciplinary research. The non-selective dissemination of contents pages leaves room for the serendipitious discovery of relevant articles in journals outside a researcher's principal area of interest. Furthermore, it is possible that the very size of the contents pages compilation may increase the stature of the library and nence lead to an increase in usage.[35]

The Canadian Organization for Development through Education (CODE)

has organized a contents page dissemination programme with document delivery backup, under a project entitled "Canadian Journals of Research--Distribution Experiment," funded by the International Development Research Centre (IDRC), National Science and Engineering Research Council (NSERC) of Canada, and the Committee on Overseas University Libraries Support.[36] A number of local STI libraries (CISIR, University of Ruhuna) are provided with Canadian STI journals and funds for photocopying of contents pages and for document delivery. They have informed other local STI libraries of the availability of the services and begun to supply contents pages to interested libraries. Records of contents pages disseminated and document delivery requests satisfied are maintained. The CISIR reports that it sent a total of 632 copies of contents pages to 27 libraries in 1986, and received 196 document delivery requests from 21 researchers.[37] Though these figures are not discouraging, reports from user libraries were not very positive. The scheme is not based on any form of profile-matching; too many contents pages, some quite dated, are sent in a single mailing; and there is high probability of the contents pages delaying in reaching the users because there are too many intermediaries (library personnel and section heads).

In addition to the formal sources of obtaining information on information, scientists have developed informal methods. Some prolific researchers maintain extensive international correspondence networks with researchers in their areas.[38] The information received from better informed foreign colleagues, including references in reprints, are used to write away for further reprints. The printed reprint card has become an indispensable tool of the Sri Lankan

scientist. This is a low-cost but highly customized and contextualized system of obtaining information. However, some researchers have found that foreign colleagues who have merely provided information sometimes expect co-authorship.[39] Certain researchers working in highly specialized and active areas of research are able to obtain free information support, including offline searches and SDI services, from associated institutions.[40]

Finding information on information is not enough. It is also necessary to obtain some or all of the located documents. If ever there was a time when all the documents that would be required by a particular set of users was expected to be found within the four walls of a library, that time is now well past. All that can be realistically expected of a library is that it provide adequate sources of information on information; that it carry the core documents that would be required by the users; and that mechanisms for obtaining the peripheral documents, or document delivery, be available.

The importance of document delivery in an STI system that gives primacy to the network aspect is quite different from that in a system where the network aspect is subordinate to the library (in the sense of a storehouse of information). Systems of the latter type are still the more prevalent. Library practice in the developed countries has been to carry the core stock and rely on inter-library loan (ILL) as the principal mode of document delivery for peripheral items.

Sri Lankan STI libraries follow the same practice though use of

inter-library loans in Sri Lanka is nowhere near the levels found in developed countries. This is not because they are more self-sufficient than their richer counterparts, but because the communicational aspect of libraries is underdeveloped and because users in Sri Lanka are very much less demanding than those in the developed countries. Not a single STI library in Sri Lanka has a specialized ILL librarian or even a clerical staff person dedicated to ILL work; only 9 out of 58 (15.5%) libraries responding to the study questionnaire reported sending out over 100 ILL requests per year.

ILL Requests Sent Out by Libraries

ILL/year	% of Libraries
0	10.3
1-25	39.7
26-50	22.4
51-100	12.1
>100	15.5
	100.0

N = 58

Source: Questionnaire response based on librarians' estimates of ILL transactions for 1986-87.

TABLE 3

The basic requirement for ILL is complete bibliographic and locational data. The former is obtained through the A&I services described above. Where a user's bibliographic data are incomplete, as tends to be the case when data is obtained through informal methods, the user or the user's librarian must utilize A&I services to fill the gaps. Locational data, in the sense of library location, is not given by A&I services. Some A&I services such as Current Contents

provide locational data in the form of author addresses but this is not applicable to formal ILL activity. What is required is a union list of periodicals (and of books, if book contents are of interest) with details of location and holdings, specific to a library network.

Preparation of union lists of periodicals and books for Sri Lanka was identified as the first task of a national S&T documentation centre in the Samarasinghe Report of 1969.[41] The union list for S&T periodicals, UNILIST, was first issued by SLSTIC in 1979. Despite the delay in updating in the print format, it is a well used library tool. Fifty two percent of the responding libraries cited UNILIST as the ILL locational tool. All interviewees expressed satisfaction with UNILIST, though most felt the updating frequency could be increased. This does not appear to be a difficult task since the basic data is in the SLSTIC computer and all that needs to be done is the preparation of low-cost printouts. SLSTIC may decide to provide computer-equipped libraries with UNILIST-on-diskette, once the conversion from the Wang MVP 2200 to the CDS-ISIS format[42] is done. The data in UNILIST is not subject to rapid change and static modes of distribution such as print and diskette are quite appropriate. In addition to UNILIST, the HeLLIS subsystem has a union list of its own.[43] The University of Peradeniya which has a decentralized library system has also prepared a computerized union list of periodicals to facilitate usage within the university system.[44]

In addition to the formal tools, librarians and users utilize personal knowledge as a source of locational data. Fifty percent of the librarians responding to the questionnaire cited personal

knowledge, some, in addition to UNILIST. Relationships based on past employment, friendship, etc. play a not unimportant role within a small STI community. Response or the lack thereof to previous requests appears to be a major factor in the choice of a library for ILL requests. This could result in the overburdening of responsive libraries, which may have long-term ill-effects on a voluntary ILL system with no monetary transfers such as that found in Sri Lanka. The assymetric nature of all ILL networks, where certain libraries function as net suppliers and other as net receivers, is found in the Sri Lankan system.

ILL Requests Received by Libraries

ILL/year	% of Libraries
0	22.4
1-25	41.4
26-50	13.8
51-100	13.8
>100	8.6
	100.0

N = 58

Source: Questionnaire responses based on librarian estimates of 1986-87 transactions.

TABLE 4

Librarian Perceptions of ILL Source/Receiver Status

	No. Libraries	%
ILLs Supplied > Received	05	8.6
ILLs Supplied = Received	35	60.3
ILLs Supplied < Received	18	31.1

N = 58

Source: Questionnaire responses based on librarian estimates of 1986-87 transactions.

TABLE 5

Perceptions of ILL source/receiver status are important because they have direct impact on ILL policy. However, the detailed but incomplete information on ILL transactions gathered in the course of interviews suggests that librarian perceptions do not always reflect the actual state of affairs. Since a mere 8.6 percent of librarians perceive their libraries as net suppliers, there does not appear to be an imminent problem in terms of resistance building up to free ILL.

Under certain circumstances, ILL requests are sent outside domestic networks. One may expect higher external ILL activity in an underdeveloped STI system such as that found in Sri Lanka. However, the negative factors are the absence of established procedures, costs and lack of locational data. Sri Lankan STI libraries utilize the services offered by the British Library Document Supply Centre (BLDSC), formerly British Library Lending Division (BLLD), for their external ILL requirements because of the comprehensive nature of the BLDSC collection, the efficiency of its operation, and the free distribution of BLDSC coupons by the Overseas Development Agency (ODA). Of all the libraries where interviews were conducted, only the Science Faculty library of the University of Colombo reported using another library in addition to the BLDSC, the Australian National Library (ANL), for external ILL. The turnaround time of ANL is reported to be even better than that of the BLDSC.[45] In all cases of external ILL use, the local library did not commit any resources other than airmail postage. All libraries utilized ODA grants, other project funds, or obtained free coupons by writing directly to the

ILL suppliers. However, almost all libraries practised some form of rationing even with the "free good". Most librarians were aware of the actual cost of a BLDSC coupon (currently Rs 142.10 for every 10 or less pages) and treated it as a method of last resort. Many were aware that BLDSC would be more prompt in responding to an ILL request than a local library, but only the University of Colombo Science Library utilized foreign ILL services as the first choice.

Colombo University Science ILL Requests

	1983	1984	1985	1986
Foreign	143/191*	96/113	163/188	104/104
Local	90/161	16/16	7/17	11/19

* x/y [x = fulfilled requests; y = total requests]

Source: Interview, S.G.S. Yapa, 24 August 1987.

TABLE 6

The University of Colombo Science Library ILL figures may portend a situation where the relative efficiency of the external network vis-a-vis the domestic network makes geographic distance irrelevant, making London closer and more accessible to Colombo, than Nugegoda.

All interviewees, with the exception of the librarian of the Post Graduate Institute of Agriculture (PGIA) and some members of HeLLIS, expressed satisfaction with the external ILL services. The PGIA fulfilment figures are quite low and inexplicable.

PGIA External ILL Fulfilment Rates

1983	1984	1985	1986	1987
03/28*	00/04	04/42	05/13	00/04 (Aug)

* x/y [x = fulfilled requests; y = total requests]

Source: Interview, J.V. Fernando, PGIA, 10 August 1987.

TABLE 7

The problem with HeLLIS appears to be caused by the hierarchical structure necessitating the channelling of all ILL requests first through the national focal point (University of Colombo Medical Library) and then through the South East Asian Regional Office of the WHO in New Delhi. The national focal point deals with requests expeditiously but it is felt that the New Delhi office is understaffed. New Delhi has responded to complaints over delay by criticising the incomplete ILL requests sent by HeLLIS members.[46] Since the intermediate points appear to be doing little more than transferring ILL forms from one envelope to another, HeLLIS may wish to adopt a decentralized structure that allows horizontal ILL transactions between members on the basis of a regularly updated union list. This is feasible because HeLLIS is a regional network and has its own funds.

Satisfaction with the domestic ILL system is high, if one were to accept the response to the questionnaire at face value. Forty six of the respondents (79.3%) stated they were satisfied with the ILL system, as against the eight (13.8%) who expressed dissatisfaction and the four (6.9%) who did not answer. However, the fact that twenty three respondents (39.7%) gave reasons for dissatisfaction in the very next question suggests a higher level of dissatisfaction.

Furthermore, interview questions regarding the ILL system elicited more criticism than would be suggested by the eighty per cent approval rating. Domestic ILL fulfilment rates given below suggest that ILL system could do with improvement. The data from which the fulfilment rates were calculated do not reflect delays, etc. If delays (which were referred to by many librarians during interviews) are taken into account, the 60-70 per cent fulfilment rate will decrease further. SLSTIC may consider undertaking an ILL fulfilment study over the next year, with systematic collection of data and focussing on factors giving rise to delay. The objective should be the setting of ILL standards. [47]

Selected ILL Fulfilment Rates

	1983	1984	1985	1986
CRI*	--	--	77.6%	80.4%
PGIA	52.2%	60.0%	67.2%	69.8%
UP/E	95.8%	55.0%	58.3%	89.5%
UP/M	89.4%	53.3%	68.4%	63.5%
UC/S	55.9%	100.0%	41.2%	57.9%
Overall**	68.6%	59.6%	68.1%	71.4%

* Standard SLSTINET abbreviations. See Appendix III.
** Note: The overall figure has limited value since the selection criterion was availability of data.

Source: Interviews.

TABLE 8

The SLSTINET ILL system is a hybrid system that allows horizontal transactions between member libraries and also provides for a node (SLSTIC) to accept and channel ILL requests. Most transactions appear to be done between libraries, with SLSTIC being considered a provider of last resort, especially because of its computerized and updated union lists and larger budget. Where a document is unavailable

locally, SLSTIC will send out an external request, to INSDOC in India or to BLDSC. However, these requests may take considerable time to be processed because SLSTIC sometimes wishes to ascertain whether the user will accept financial responsibility.[46] The number of ILL requests handled by SLSTIC was about the same as a large library, indicating a low utilization of the ILL node.

SLSTIC ILL Transactions

	1981	1982	1983	1984	1985	1986
Domestic	120	23	98	207	101	58
Foreign	38	26	52	50	--	06

* January-July only.

Source: SLSTIC, Annual Reports, various years.

TABLE 9

In addition to the formal ILL mechanisms, there exist a number of informal channels. A very important one is the user's visit to the library holding the required document. This method is quite prevalent in Colombo and Kandy where a number of S&T institutions are agglomerated. Researchers visit libraries where the desired items are known to be available by official vehicle and/or with authorizing letters from their own librarians. The photocopies obtained through such visits will not appear in the formal ILL statistics. The unusually low ILL figures from the Science Faculty libraries at the University of Peradeniya, an active research centre, indicates that there is substantial bypass of the library system.

ILL Requests Originating from Peradeniya Science Libraries

	1983	1984	1985	1986	1987
Domestic	04/05*	03/04	01/01	05/16**	
Foreign	0/01	0/0	0/0	0/0	

* x/y [x = satisfied requests; y = total requests]
**June 1986 - June 1987

Source: University of Peradeniya, Annual Report, various years; Interview, Sriyani Perera, Assistant Librarian Science, University of Peradeniya, 11 August 1987.

TABLE 10

The extremely decentralized structure of the Peradeniya science libraries, with departmental libraries coming under the administration of the respective departmental heads, and the absence of a trained librarian in every library may have given rise to such low expectations of library services that users have evolved rather extensive bypass mechanisms. Comparison with the ILL figures for the Colombo University Science Library (Table 6) leaves little doubt that bypass is occurring. This conclusion is confirmed by the remarks of Prof Leslie Gunatilake, Head of the Peradeniya Department of Chemistry, at a seminar on chemical information where he bemoaned the lack of library facilities and described how he and other scientists obtained literature through personal contacts and during foreign visits.[49] Bypass is a serious phenomenon with negative impact for the role of libraries and for the efficient conduct of scientific research.

Problems

The period since 1968, the beginning of formal STI policy

intervention, has seen significant advances in the transformation of isolated STI libraries into an integrated STI network. The beginnings of basic structural changes have been made and some of the key mechanisms for further progress are in place. An example of the former is UNILIST. The best example of the latter is SLSTINET itself, which has created a community of STI professionals.

The value of a network is not self-evident, though common wisdom has come to take it as such. A network will result in a diminution of the control exercised by the librarian and the institution over the provision of STI. It can also lead to additional burdens in the form of financial (direct or indirect) and manpower demands. Yet, the benefits of networks are perceived to be greater than these costs. Optimization of limited resources is the most important justification for a STI network in a Third-World setting. In addition, the network in itself could be a benefit. It could be utilized to promote communication between scientists.

In Sri Lanka, the emphasis has been on resource sharing. Network activities have focussed on the "rationalization" of the purchase of A&I journals and the facilitation of interlibrary loans. What is seen is a defensive response to hostile environmental factors -- erratically escalating journal prices, particularly in the high-cost and indispensable A&I journals segment, and budget constraints. The crisis has not been turned into an opportunity to restructure a far from perfect STI system. The defensive response of cutting quality is exemplified by the Cooperative Acquisitions Programme (A&I) where the objective is deletion of titles leaving at least one in the island,

or a region. What makes this a quality-cutting exercise is the lack of imaginative and innovative measures to maintain, if not enhance user access to the vital A&I journals. And this despite the Sri Lankan STI community being aware of the fact that:

> One of the firmest conclusions of information usage surveys [is] that the intrinsic value of an information channel has little or no bearing on the frequency with which it is used. The important factor is always its accessibility.[50]

The problem remains: how can the Sri Lankan STI users scattered in a multitude of institutions and with a broad range of research interests, be provided with the best possible access to information on information, within the existing resource constraints? The various SDI services within institutions, the contents page dissemination programmes, offline search facilities, etc. are all isolated attempts to address the problem. There is room yet for attempting to integrate the different elements, possibly utilizing new information and communication technologies.

The second major component of the network building exercise has been centred on document delivery. This necessarily follows from improvement of information on information as well as from reduced access to on-site primary journals due to price and budget factors. The communication process has two parts. First, the request for the document must be communicated to the library with the item in its holdings. This requires identifying the library and sending the request containing the necessary details in the shortest possible time period. The second part of the transaction is the delivery of the document, again within the shortest possible time period. There

are subsidiary elements such as communicating the fact that the request cannot be met, redirecting requests, sending reminders, etc.

At present the above information transactions are effected through the postal system, though a number of libraries with good telephone access reported using the telephone to locate the appropriate library or to inquire about long delays. In an overall sense, there are no systematic attempts to improve on turnaround times and reliability. Librarians are not agreed on the importance of speed in the processing of ILL requests. Some feel that lack of specific demands or complaints from users indicates indifference to or satisfaction with current ILL performance. What is not realized is that silence may mean many other things too. The user may become disgusted at library performance and switch to bypass mechanisms or learn to make do without STI.

A fundamental and widespread problem affecting the Sri Lankan STI system is under/non utilization of available resources by researchers. This was candidly discussed by Schwartz in his perceptive 1979 report.[51] The issue was almost invariably raised by librarians during the in-depth interviews, despite the fact that it was not on the "agenda" suggested by the sample questions sent beforehand. Since the user is at the heart of the STI system, the question of non/under utilization must be a central element of every attempt to improve the system.

3. THE NEW TECHNOLOGIES

Of the three information and communication technologies discussed in this report, online and microform have found major applications in libraries and information systems in the developed countries over the past number of decades. In fact, some would be surprised to hear microform described as a new technology. The first microform product for use in a library, the New York Times, 1914-18, was produced in 1935 and University Microfilms, Inc., even today a major player in the information industry, was established in 1938.[52] However, microform is a new technology in the Sri Lankan setting, being introduced to Sri Lankan libraries only a decade or so ago. Online, which arrived in the North American library scene in the 1960s,[53] has been available in Sri Lanka since January 1987. CD-ROM and associated optical technologies for data storage are the newest on the scene. CD-ROM for storage of digital data began to be marketed in 1985.[54] Sri Lanka's first CD-ROM system was installed in July 1987.

The three technologies differ from each other at the most basic technical level in the mode of data storage: microform on photographic film; online on magnetic media; and CD-ROM on optical media. However, technical differences do not constitute the totality of technological differences. A brief summary of the technological characteristics, including Sri Lankan usage to date, for each of the technologies is given below.

Microform

Technical Aspects. Microform material is simply textual or graphical

information stored in reduced size on photographic film. The two most common formats are microfiche (a sheet of processed film, usually 105 mm x 148 mm bearing microimages in a grid pattern and a "header strip" with identification legible to the unaided eye) and microfilm (a roll of film bearing microimages in a sequential pattern, usually without a legible header strip).[55]

Data input is easy, inexpensive and fast, though the input data cannot be accessed immediately thereafter. Input data cannot be manipulated easily. Microform is unrivalled in terms of cheap storage and preservative qualities.

Microform is a "serial" medium, necessitating forward and backward searches for retrieval.[56], However, its compactness has been found to confer advantages for "consultation" or "reference" type uses where the eye need not be focussed on the screen for long periods at a time.[57] Computer-aided retrieval (CAR) techniques have been developed to improve microform's retrievability characteristics. CAR has been combined with computer output microfilm (COM) techniques to integrate microform with computers. However, microform is not intrinsically a dynamic medium. Its strengths lie elsewhere.[58] CAR and COM techniques have been developed principally for office management applications, hence the attractive pricing features of mass-market products are absent.

Special readers or reader-printers are necessary, though the data is basically human-readable (i.e., not digitized). If the user wishes to take away or read a paper version of a document stored in microform,

a reader-printer will be required.

Microforms have been used in developed-country libraries successfully for storage of back issues of periodicals, especially voluminous ones like newspapers. However, this necessitates the purchase of the microform version, in addition to the print version which is discarded after current use. A separate index, usually in print form is provided. The additional costs are justified in terms of space and labour saving, file integrity, and user convenience. The arithmetic of the space and labour saving factor is different in a Third-World setting, though the other two are directly relevant.

Products and Marketing. The market may be examined from two perspectives: from that of the user of information in micrographic format; and from that of the producer of such information products.

In the first case, the consumer is in the market for microform reader and/or printer equipment and for A&I journals, primary journals, books, etc. in micrographic format. In addition, document delivery in microform will also be considered. Microform is a mature technology and there are established suppliers and products. A majority of the reader-printers in Sri Lanka use special paper which has keeping problems. However, normal paper printers are now available. Certain machines which have been supplied under foreign grants have proved difficult to maintain, or even install, due to lack of local service support. However, there are an adequate number of product lines with local agent support, as evidenced by a number of library tender bids that were processed recently. The price of a new microfiche reader-

printer is in the range of Rs 150,000.[59] It must be noted that one or even two fairly sophisticated microcomputers may be purchased for this amount. The cost of a hardcopy generated by a reader-printer, not including capital costs, has been calculated to be around Rs 3, or double the cost of an ordinary photocopy.[60]

A number of A&I journals are available in micrographic format, including AGRINDEX (produced by FAO-AGRIS and available in Sri Lanka) and Chemical Abstracts (unavailable in Sri Lanka). A&I journals in microform offer advantages only in binding costs and space, and significant disadvantages in searchability. Pricing is discussed by Teague:

> As computerisation is introduced specifically in order to produce the paper edition and the computer output microform edition is in some sense a competing by-product of this process, together with the fact that libraries constitute the only market, a purchase in microform means one less in paper format and there can be no price advantage.
>
> . . . . . .
>
> Considerable price benefit is offered to the purchaser of the printed edition [of Chemical Abstracts] over the microfilm or microfiche price. The reason appears to be the false assumption that purchase of a microform edition implies a desire to indulge in extensive copying, thus reducing demand for the original service.[61]

There are no significant savings in terms of speed of delivery, or postage costs (at least with regard to Chemical Abstracts which is now airmailed as part of the subscription[62]).

Document delivery is available in microform, usually as an alternative to print, but in a few cases as the only format. In certain cases the savings are significant. However, if the requesting

library has to convert the microform document to print (as had been the case with theses ordered by the Coconut Research Institute), the real costs may be higher than thought.

Micrography is a relatively cheap method of document production. Fairly sophisticated camera and other equipment is available. Libraries which need to send bulky reports or other publications abroad may find microform attractive. There is, however, no necessity of purchasing equipment for this type of occasional use. The machines already installed, such as that at SLSTIC or those which have preservation as the prime application, can easily handle such work.

Sri Lankan Situation. The Samarasinghe Report of 1969 recommended the acquisition of microfilm and/or microfiche reader-printer facilities by the proposed National S&T Documentation Centre for use in the document procurement service in the belief that "[f]oreign centres will generally provide . . . information on microfilm or microfiche."[63] By the time SLSTIC was established, a decade later, the notion of using microform for document procurement (requiring only reader or reader-printer equipment) had been replaced or supplemented by that of some form of micropublishing (requiring more expensive cameras, etc. in addition to a reader). The purchase of a complete diazo microfiche system for SLSTIC was a major item of the USD 300,000 spent on equipment as part of the UNDP project of 1977-82. There is another micropublishing facility at the Agricultural Research and Training Institute (ARTI) provided as part of a grant by USAID. The micropublishing facility at SLSTIC has been used for many purposes. For example, the micropublishing of the documents at the

Coconut Information Centre to facilitate decentralized document delivery within the international coconut information network is being done on contract by the SLSTIC facility. Some non-library work has also been undertaken. The facility has also made it possible to supply local scientific reports and publications to foreign requestors in microform. Offers to supply SLSTINET members with UNICAST products on microform at one-fifth the price of paper output (Rs 25 as against Rs 125 for the paper),[64] does not appear to have met with much demand.

A&I services on microform were available at four of the libraries visited during the study. Significant usage was reported only at the Central Library of the Department of Agriculture (DAG) where AGRINDEX on microfiche was used in preference to the print version. This may be explained by the fact that the current fiche precedes the print version by one month, the inconvenience of using the very bulky print volumes, and the careful eradication of librarian microphobia by a foreign expert. It was also reported that researchers are encouraged to use the microfiche reader. However, DAG did not order documents on microform and thus did not utilize the reader-printer for document delivery functions.[65]

The basic fact is that microform usage in Sri Lanka is very low. With the exception of the Department of Agriculture and the Coconut Research Institute, little or no usage of microforms was reported from the libraries visited during the study. The questionnaire response indicates a fairly high level of availability of microform reader/printer equipment, 20 libraries (34.5%) possessing the basic

reading capability, likely to go up to 41.4 per cent within the next year as more libraries receive approved/ordered equipment. However, the reality is that the 34.5 per cent includes machines in store rooms that have never once been used. Not a single librarian reported obtaining documents from domestic or foreign sources for use in microform format, as distinguished from obtaining microforms which were then converted to print as had been done at the CRI library. A number of librarians spoke of the need to obtain reader-printers in order to give users entire documents in print format. This cannot be described as a proper utilization of the microform technology. The principal motivation for microform purchases by the universities appears to be preservation. In a few institutions such as the CRI and the Department of Agriculture, microform has been introduced as an integral element of an information system. In no case is it used as a principal medium, or at its full potential.

Online

Technical Aspects. Online is the harnessing of the massive power and storage capacities of mainframe computers, custom-made software and magnetic memory devices for remote automated information retrieval via cheap telecommunication facilities, principally data communications. The techno-economic basis of the online industry is the aggregation of demand to a level adequate for the efficient usage of large facilities. The industry has three main components: database producers, principally conventional publishers and non-profit professional societies; online vendors, who mount the databases on large computer facilities and make available search software, user support, billing, and other facilities; and networks which connect

users with online vendors.

The software originally developed for large mainframes by online vendors (now being made available for smaller computers including those coupled to optical memory devices) is the principal strength of online technology. It not only performs at incredible speeds conventional retrieval procedures such as author or title searches, but executes retrieval operations from many access points and with a sophistication that would be more or less unthinkable with manual retrieval. The distinguishing features of the current stage of online technology (described as the "third generation) are mass random access memory, interactive terminal processing and telecommunications.[66]

Interactivity, whereby users "converse" with the computer in directing the search, is the major user benefit. Searching is progressing from key-word searching and rigidly controlled vocabularies through natural language access and free-text searching to expert systems. The driving force behind this trend is the need to expand the user base from expert intermediaries to the large number of "endusers" unwilling to invest large amounts of time and effort in learning search procedures.

From the user's perspective, online is not very complicated. All that is required is a "dumb" computer terminal or a microcomputer with communications software (the former can only be used for remote access and has little relevance in Third-World settings), a modem, a telephone line, and a password. The computer can be used for other

things when not online. The modem is a device for converting digital data from the computer into a format acceptable for transmission on a telephone line. The speed at which communication with the host computer occurs is defined by the modem (usually 300 bauds or 1,200 bauds) and the quality of the telephone lines. Ideally, the user's telephone line would connect to a nearby data communication node, from which point the data would be transmitted reliably and at very low cost relative to voice lines to the host computer's interface. Voice lines are expensive and, not being designed for data transmission, liable to introduce errors. In Sri Lanka, internal voice telephone lines are somewhat unreliable for use with ordinary modems. There is no data network node in Sri Lanka, with the result that voice lines (yielding reliable transmission only at the low speed of 300 bauds) have to be used to get to the closest data node. Currently it costs Rs 54 per minute to connect a computer to a data node in Singapore. The cost from Singapore to a vendor in North America is around Rs 8, though it is possible to enrol in a subscription plan that may yield even lower per-minute costs depending on usage.[67] This adds up to a total telecommunications cost of around Rs 60 per minute. It must be noted that the slow speed imposed by technical limitations of the Sri Lankan telephone system imposes additional costs in the form of longer than necessary connect time.

Products and Markets. A wide range of information products are available online. There are a number of competing vendors: Dialog, ESA-IRS, Pergamon Orbit InfoLine, BRS, STN International, etc. Both fulltext and reference databases are available though reference

databases still constitute the bulk of the offerings. Reference databases is another name for the familiar A&I services. They provide information on information. The next step of obtaining the located document requires either the online ordering of documents for delivery by post or obtaining the document from one's own library or through local or international interlibrary loan. Since a few years back, a limited number of scientific periodicals (19 primary journals of the American Chemical Society to be joined in 1987 by a number of journals from the Royal Society of Chemistry and chemical journals from John Wiley and Sons) have been available online as fulltext databases. These are, however, without graphics. Theoretically, the online link may be used not only to search the database but also to obtain the document. However, this will be very costly in Sri Lanka due to high telecommunication costs and slow data rates. User studies have shown that fulltext databases are being used as sophisticated reference tools, more than as document delivery devices.[68]

Almost all the A&I journals produced in the Western countries are available online. There are some minor exceptions such as Astronomy and Astrophysics Abstracts. There are a number of online products with no print equivalents such as Mental Health Abstracts, and EMIS [Electronic Materials Information Service], and some that correspond in part to several abstracting journals but where half the online records do not appear in print format anywhere, such as DOE Energy. Chemical Abstracts is provided without abstracts by all online vendors with the exception of STN International.[69] Reference works such as the Kirk-Othmer Encyclopedia of Chemical Technology and mass spectral databases are also available online. One limitation is

backfiles. In the sciences the files usually go back only 10-15 years. A&I services from non-metropolitan countries are usually not available online. One exception is the AGE database produced by the Asian Information Centre for Geotechnical Engineering at the Asian Institute of Technology (AIT), Bangkok. It is available online from ESA-IRS.

Online vendors supply ancillary products such as electronic mail and SDI services. The latter is provided by storing searches, rerunning them on updated portions of specified databases and providing online output or offline prints. This is an operation done in batch mode and qualifies for volume discounts in most cases.[70]

Online is distinguished from almost all other information products by its method of pricing. Whereas print, microform, and even optical products are sold or licensed on a fixed-price basis, online pricing is usage-based. Even though there may be additional charges for usage of computer resources and types of formats, the basis of online pricing is usage. The negative aspect is the absence of fixed prices leading to difficulties in budgeting, especially for those used to the fixed-price static world of library expenditures. The positive aspect is the benefit to light users and users of peripheral journals.

> In print subscription days . . . a small number of large users were, effectively, subsidised by a large number of small users -- Ciba-Geigy or ICI paid Chem Abs the same amout of money for their access to the print product as any other user did. With online, the equation started to swing, with a small number of large users spending, in some cases, hundreds of thousands of dollars a year in access fees to a single file thus subsidising the occasional or small user's couple of hundred dollars a year access.[71]

Irrespective of the validity of the subsidy argument, the basic point is that online has an edge over print for countries suffering from the thin-layer problem, as far as online vendor costs are concerned. The advantage is reduced, and the balance may even shift, in case where telecommunication costs are excessive.

Sri Lankan Situation. There is one online bureau in Sri Lanka. The Sri Lanka Business Development Centre (SLBDC), a non-profit organization, established the bureau in January 1987 principally as a service to exporters and industrialists. The SLBDC bureau uses a microcomputer equipped with a 300 baud Hayes modem to dial up a data network node in Singapore on an ISD voice telephone line. The bureau has passwords to Dialog, Pergamon Orbit InfoLine and a German business database vendor. The searcher is a librarian experienced in industrial information work. The average number of searches is about six per month, amounting to a total of about 50 minutes of connect-time. Users are charged a uniform rate of Rs 135 per minute, irrespective of the actual database fee. Except for three clients (four searches), all others have been from the prime target group of exporters and industrialists. The investigator in the present study ran two searches, one quite successful and the other (the search for the present study) moderately so. The other two academic/scientific clients had not been satisfied.[72]

The bureau asked for three weeks turnaround time in the early brochures, but was reasonably prompt in actual practice. However, the practice of executing the search in the absence of the client made

several visits and telephone calls necessary, and may have contributed to the low rate of satisfaction among scientific/academic users (whose subjects were foreign to the actual searcher). Another academic-type user reported difficulty in locating an appropriate database, as a result of which the search exercise was abandoned.[73]

The Institute of Fundamental Studies, a government research organization of fairly recent origin, examined the question of establishing a library with online as its cornerstone in 1985-86. Two internal proposals, one for establishing a data communications link and the other for a pilot project on accessing ESA-IRS and obtaining documents from BLDSC were prepared, as well as a Final Report which recommended against the project as it stood in July 1986. It is reported that the IFS is now examining the feasibility of utilizing optical disks for its library.[74]

Optical Disks (CD-ROM)

Technical Aspects. Optical storage is at the heart of the technology. A laser (or lasers) is used to burn micron size pits on a glass or plastic master disk. The resulting pits and lands represent digital 1s and 0s. The required number of optical disks are stamped from the master disk. The process is very complex, given the incredible level of precision that is required. Key operations take place in "clean rooms" using robotics, so dust will not create "noise" on the disks.[75] The disks are read using special drives equipped with laser heads, functioning as microcomputer accessories. There is no physical contact between the head and the disk as the data is read into the computer. The reliability of the medium is very high as is its data

storage capacity.[76] The retrieval speed varies depending on the software, but is generally slower than with magnetic media. Hitachi, the dominant manufacturer of drives has claimed an access time of 1 second for CD-ROM, compared to .2 secs for floppy disks and .15 secs for hard disk drives. A test search comparison of Medline on Dialog and Compact Cambridge-Medline CD-ROM found a seek time differential of 1:5, confirming Hitachi's figures.[77]

There are many kinds of digital optical disks at varying levels of development, ranging from twelve-inch diameter write-once read-many disks (WORMs) to the twelve-centimeter CD-ROM [Compact Disk - Read Only Memory]. The latter is connected to the mass-market product CD-Audio, a substitute to the phonograph record which does not scratch and produces extremely high-quality sound. Though data storage and retrieval activities are being done on other formats,[78] CD-ROM is by far the most important in terms of scientific publishing and database dissemination. The main reasons are the substantial progress made on standardization and the lower costs flowing from the association with the mass-market CD-Audio.

One 12cm CD-ROM disk can hold 552 megabytes of data, equivalent to 890 floppy disks (of 0.62 Mb each), or around 275,000 typed pages.[79] In actual fact a disk will not hold all that much, since indexes and inverted files, as well as the retrieval software that is usually embedded in the disk take up a lot of space. One writer has claimed that only about 300 Mb is available for data.[80]

Products and Marketing. CD-ROM can offer massive data storage,

occupying very little space. Under certain conditions, it can also offer very inexpensive data storage. These two potentialities of the new medium have given rise to much excitement and some product development. Ideally, there could be a Dialog on every desk top: a microcomputer, a connected CD-ROM drive, and a box full of CD-ROMs; no telecommunication charges or hassles,[81] and no "taxi-meter" ticking away as one searches.

The ideal is difficult to achieve because of a number of reasons. The per-unit cost of making a CD-ROM (which has to be contracted to one of the 11+ mastering facilities now in existence) is low only if there is a long production run. Per-unit replication costs drop to USD 5 only when the quantity exceeds 5,000.[82] The mastering cost, which is in the range of USD 5,600-9,900 depending on turnaround time, must be added as well as royalties and other production costs. This takes the breakeven point quite high. If the production run is less than, say, 5,000, the breakeven is even more difficult to achieve. A related difficulty is the lack of an established base of CD-ROM drives. As long as the drives are not there, large-volume sales will be constrained. As long as cheap and useful CD-ROM information products do not come to market, there will be no incentive to buy drives.[83]

Despite the difficulties, a number of CD-ROM database products have been put on the market. Dialog is marketing its first CD-ROM product, ERIC (current; 1981-present; 1 disk) for USD 950 (down from USD 1,950 at release) and the ERIC-complete file (1966-present; 3 disks) for USD 1,650 (down from USD 3,450) and will be releasing OnDisc Medline

shortly. It must be noted that ERIC is a public domain database for which Dialog does not pay royalties. ERIC is also offered by SilverPlatter at USD 650 a year (down from USD 1,750) with quarterly updates. Aquatic Sciences and Fisheries Abstracts, USD 522 in print form, is offered by Cambridge Science Abstracts for USD 2,250 annual subscription. This disk is available in Sri Lanka at the National Aquatic Resources Agency (NARA), donated by UNDP together with a CD-ROM drive (offered at USD 500 annual subscription by CSA). Library and Information Science Abstracts (LISA) is marketed by SilverPlatter for USD 995 per year (print version costs approximately USD 311), on an annual update basis, and USD 4,995 for outright purchase. The current annual subscription price is a massive climb-down from the USD 5,000 per year suggested earlier. Wiley Electronic Publishing announced a CD-ROM Registry of Mass Spectral Data, containing 120,000 spectra records and search software, for USD 2,495. A subset of Chemical Abstracts, Health and safety in Chemistry, Current Biotechnology Abstracts, Electrical and Computer Engineering (Compendex) are among the other available products. A number of library products such as Ulrich's International Periodicals Directory (USD 395, cheaper than the print version) are available.

CD-ROM drives are being marketed at various prices, under various payment schemes. Dialog offers a Philips CD-ROM drive for USD 740 along with its OnDisc products. Prices range from a low of USD 680 to a high of USD 2,800.[84]

CD-ROM is a static medium. It cannot be updated as such. The manner of updating is making a fresh CD with the old and the new data and

throwing away the old CD. Because the old disk contains valuable data and software, the supplier usually insists that it be returned. Article 7 of the Dialog On Disc license agreement states:

> Updates are made on an exchange/replacement basis and Customer's refusal, delay or inability to return replaced portions of Products shall be good cause for DIALOG to withold shipment . . . [T]he license and rights granted to Customer . . . shall terminate with respect to replaced products upon DIALOG's making available . . . a replacing Product or portion. Customer shall utilize a traceable method of transit when returning products to DIALOG.

The vendors have realized the disks will be used in library settings and have made provision in the license agreements for allowing such access.

Market developments to date suggest four things. First, that there will be more static, compilation-type products coming to market than the dynamic A&I services. Statistical data for demographic analysis combined with post codes, or geographical data appear to fit the medium better than indexes and abstracts. It is not that A&I services will not be made available on disk, but that vendors will be somewhat cautious in this area. Secondly, it is possible that certain vendors will make available backfiles on disk, possibly even on an exclusive basis. The question will be whether users will invest in the equipment and the disks only for backfiles. Thirdly, prices will remain volatile for some time. The price behaviour so far may be interpreted in two ways. First, that prices are coming down, as was the case with CD-Audio. Second, that the sellers are trying to find out what the market responses are and/or are taking defensive action in an uncertain and sluggish market. The second interpretation is

more plausible. Fourth, it may be risky to invest in drives, etc., in order to use particular databases. Databases will continue to be available on disk, but the same database may not be available in disk form continuously, unless it has a training function like LISA. This again is a conclusion based on the instability displayed by the market so far.

Sri Lankan Situation. The first CD-ROM facility was installed at the National Aquatic Resources Agency (NARA) library in July 1987. It is in use, with one disk containing the disk version of the Aquatic Sciences and Fisheries Abstracts online database. The print version of ASFA is also available in the library. The facility had been there for too short a time to make an evaluation of usage.

4. POLICY OPTIONS

The Sri Lankan STI system is in crisis, and has been in that condition for over a decade at least. The principal response has been resource sharing. However, the overall tenor of the response has been defensive. Librarians have been debating the least painful methods cutting the fat from the system, when there is not much of fat or even bone left, and the system has become moribund. The symptoms are there for those who wish to look: scientists giving co-authorships to suppliers of articles; 13,000 rupee A&I journals read by one user; reprint cards replacing library cards; empty libraries; duplicative research; obsolete references.

What is needed is an offensive response. Crisis, which is that condition where the status quo becomes intolerable, is the ideal opportunity for restructuring a system. The STI community must look not for ways to cut back, but for ways of enhancing the role of the library within the scientific enterprise, and for making it the communication centre of every research organization. From its current role as a brake on research activity, the STI system must be transformed into an effective science policy tool for increasing the productivity of scientific and technological research.

Grand objectives, but how can they be achieved? Not by a technological fix. Technology in itself is no cure for anything. What is needed is a different conceptualization of the STI system; innovative solutions to the problems of transition and restructuring; and the utilization of technology within those solutions. Technology

can play a vital role in marshalling policy support within and without the respective S&T institutions for the task of upgrading the role of the library. Policy-makers like technological glamour and if the STI community can come up with imaginative proposals that utilize technology in a way that actually solves problems, they are more likely to get support.

The starting point must be the user. In the present Sri Lankan context this means a frontal attack on the problem of under/non utilization of STI resources by researchers. Librarians blame scientists for not using the existing resources, yet, in most cases where they have taken information closer to the user, utilization levels have gone up. The problem of utilization can be seen in a new light if the library is conceptualized differently; not as a collection of literature to which users must come but as an agency that provides access to information; not as a static storehouse but as a dynamic link between users and information, where ever located. This conceptualization does not have to be forced on anyone. It exists in embryo in the networking initiatives of the Sri Lankan STI community. All that is necessary is its development.

How can the library go to the user? The most obvious answer, which has already been identified by a number of librarians, especially those in the research institutes, is SDI. The basic idea in SDI is the creation and maintenance of accurate research profiles for all users, the periodic matching of profiles with a database, and the communication of the results to users. What now exists within the Sri Lankan STI system is non-uniform in quality, in most cases limited to

a database made up of in-house information, manually done, and low-profile.

SDI is an ideal point for effective, high-tech intervention.[85] While the preparation and maintenance of accurate research profiles is still best done by skilled professionals, the matching of profiles with the appropriate databases is a task best suited to the mechanical thoroughness of the computer. And it is only by going to the massive data collections of the online vendors that it will be possible to dramatically expand the size of the database against which the profiles are matched. The basic automated SDI operation actually precedes online searching, having been done with purchased data tapes in the batch mode. It is a routine activity that can be done during periods of low usage of online computer facilities, and is thus relatively inexpensive.

Computerized SDI can be the starting point for the gradual building up of a state-of-the-art system for providing scientists with comprehensive, convenient and timely information on information. The first step would be for all the librarians in SLSTINET to identify users whose primary function is research. This is because it would not be realistic to supply SDI services to all of the approximately 6,000 "qualified scientific and technological personnel" in the country.[86] It may be possible to establish some criteria for selection (other than seniority) or allocate quotas to each S&T institution. It is vital that the inclusion of active junior scientists be ensured. Some mechanism for dropping and adding researchers to the list will have to be devised. Raw data for the

preparation of the profiles should be collected by the librarians prior to a comprehensive workshop on SDI and automated information retrieval techniques. Preparing the actual research profiles and the online search for SDI matching should be done as part of the workshop. The workshop should be conducted by experienced online trainers from abroad and online links to number of vendors should be set up for its duration so that the searches can be tested and perfected prior to storage. The importance of the workshop is that it will build up the skills base necessary for maintaining the SDI profiles and give the local STI community a practical introduction to automated data retrieval techniques.

A small (2-3 person) Information Access Centre (IAC) must be set up in order to become operational at the time of the workshop. It would be advisable to constitute it as an independent entity, with its own budget but subject to overall supervision by a body such as SLSTIC. It need hardly be said that the IAC should be insulated from the bureaucratic culture of NARESA and similar government organizations and that its employees/consultants be adequately remunerated if satisfactory performance is desired. One way of ensuring the above would be to set up the IAC as part of a foreign funded project and stipulate that it become self-financing after a specified period. At the outset the IAC must be equipped with adequate computer and communication facilities to carry out basic SDI functions such as updating of research profiles and the efficient mailing out of SDI output, as well as online searches. Automated and comprehensive record-keeping is an essential feature, as data for decisions on switching from online to CD-ROM, or vice versa, or between vendors

must be continuously generated. Communication levels between the IAC and foreign points as well as local libraries must be monitored in order to make intelligent decisions on introducing advanced communication facilities.

Following the SDI-information retrieval workshop where the search profiles will be prepared and stored, the responsibility for the SDI service will taken over by the IAC. The search profiles should be stored under IAC's password so that bulk discounts can be utilized. The core function of the IAC will be the SDI service. It will ensure that network libraries keep the profiles current, and respond to changes in database availability, etc. IAC will also function as an online bureau for users and libraries wishing to search particular topics or areas. The idea of an online bureau is not innovative in itself. The SLBDC has already established a bureau with an industrial orientation, as have other countries.[87] China has had an academic online bureau service since October 1983.[88] But building an online bureau service as an accessory to a regular SDI service is. The SDI service serves many functions. It educates scientists about the potential of automated information retrieval on large databases, whetting their appetite for online. The regular mailings of SDI output and other material keeps the network active. The SDI service keeps the IAC staff occupied and in contact with information industry developments. If not for SDI they might have one hour's work a week, if the experience of SLBDC is anything to go by. And perhaps most importantly, the regular SDI-related telecommunication and mail traffic can be the base for more advanced and cost-effective electronic communication facilities such as multiplexed lines or even

data communications.

In addition to SDI and online bureau services, the IAC can also offer associated services such as expedited document delivery. The increased availability of information on information should, theoretically at least, increase the demand for document delivery. It is unlikely that a repetition of the AGRINET contents page dissemination programme would occur since IAC service will be more precisely matched and because of the associated high-tech glamour. As long as the local libraries provide document delivery using free BLDSC coupons or local ILL, there will be no demand for paid document delivery, but things may change if libraries run out of free coupons or if alternative funding arrangements are established.

IAC is envisioned as a flexible mechanism for enhancing information access by Sri Lankan research personnel utilizing the most appropriate technology. Flexibility is the key to cost-effectiveness in conditions of uncertainty. Online may be the most cost-effective for low levels of usage. However, as usage increases in certain areas, it may make sense to go into CD-ROM for heavily used databases, while continuing with online for the lightly used databases. If the prices of CD-ROM products are raised suddenly, it will still be possible to revert to online. Flexibility is also important in terms of communication technology. Continuous monitoring of usage patterns and prices (of equipment as well as services) will enable IAC to select the most appropriate mixes of services and equipment for changing levels of usage. Microform is not seen as having a significant potential for IAC's activities because of its

weak retrieval features.

So far, little was said of how the SDI and other services would be funded. At the beginning, the services would have to be provided free of charge. Funding will have to be arranged through a pilot project funded by an outside agency or with a block grant from government. But the users, or actually their institutions, should start paying for services within 2-3 years. In addition to the obvious benefit of making IAC fully or partly self-financing, payment for services is desirable because it constitutes an effective feedback loop. Operating in the information market will keep IAC honest and on its toes. The recipients of IAC services will appreciate them more if they are not free goods. As long as IAC is run as a lean operation, the uncertainties introduced by market relationships will not be unmanageable. There may be some difficulties once capital costs over and above microcomputer, modem and software packages are incurred, but good service and long contract periods should alleviate the pain.

From where will S&T institutions get the money to pay for information services? There are several options. The simplest would be some kind of information grant from government, channelled through an agency like NARESA. The S&T institutions will be free to spend it on IAC services or on things like books and periodicals, but not on non-information goods and services.

A more interesting proposal involves the phasing out of print services and the use of those funds for IAC services. A science policy agency like NARESA could establish a programme of STI Matching

Grants. Any S&T institution which cuts its print STI budget by a sum above a specified minimum would be given some multiple of the saved sum through the matching funds programme. The total sum would then have to be used for any of a number of information access services such as SDI or document delivery from IAC or other sources.

The above proposals may be criticised on two grounds. First, that they are too complicated; and second, that they involve additional expenditures. The response to the first point is that earmarked and matching funds are common policy tools, both in Sri Lanka as well as outside. It is just that these particular tools have not been used much outside agriculture (replanting incentives, etc.) and export promotion. It is high time some tools with teeth are introduced to the science policy area.

The second objection is a little more complicated. The new information and communication technologies rarely yield direct and immediate cost savings, and actually drive up direct costs in most cases, as anyone who has bought a computer will testify. The benefits are higher quality output and indirect savings, usually appearing in other areas of the organization and within a different time period. This is the case with library applications. Here is testimony from a US librarian, a veteran of the high technology wars:

> We must not try to justify this major investment in advanced technology on the grounds that it will reduce costs, because it will not. . . . When we first started using computers in libraries 20 years ago, we thought we would save money. Then we thought automation would at least reduce the rate of rise of library costs, but even this is proving illusory as the demand for new and more sophisticated systems and services increases. We are no longer merely automating our internal operations, we are providing new user services and

> access to a broader range of resources both traditional and electronic. As these new services become more efficient and more widely known, demand for them will increase, and while the unit cost of providing any given service will decline, the total cost of satisfying the increased demand will go up.[89]

The economics of fixed-cost print journals are so unfavourable to countries suffering from the thin-layer problem that switching to online searching and document delivery with their usage-based pricing schemes may actually reduce costs. In Sri Lanka's case, those savings will most probably be eaten up by telecommunications costs. Yet, the discussion of online or CD-ROM costs versus print costs misses a basic point. For a real comparison, usage in the different modes must be equivalent as must be the quality of the compared products or services. These conditions cannot be satisfied. Does anyone wish to keep usage of A&I services at the present miserable levels with online and CD-ROM? And need it be emphasized that one gets automated searching plus a massive range of databases with online, and superior and unhurried searching with CD-ROM?

The question of costs always brings up the topic of telecommunications. If the objective is good research in the sciences as they exist, there is no alternative to gaining access to the massive databases in the West. It would be wrong to rely on those sources alone as they exclude a significant amount of information generated in the tropical and poor areas of the world, but use them one must. Whatever said and done, microform and CD-ROM belong to the print genre, constituting collections. Online is generically different. It is a dynamic medium that offers access, not collections. And bundled with online comes electronic mail, still

imperfect, but giving access to informal scientific networks. The key to all this is data communications.

This study cannot go into the details of how to establish cheap telecommunication facilities. The basic point is that unit costs can be brought down only with large volumes. Library type use, in itself, cannot hope to supply anywhere near the required volume for, say, packet switching. However, if library communications are concentrated as will be the case with IAC, it is just possible that enough volume can be generated to justify a fairly simple cost-reduction technique like multiplexing (splitting a voice line into multiple lines usable simultaneously). More likely will be the possibility of IAC or a heavy library user piggybacking on the multiplexed line of a large data transferor like a bank or a data entry firm.

A key element in concentrating library communications demand is the local network. If all the libraries with computers can be connected to a node in Colombo, either by dedicated lines or by dialup lines, the communications costs problem will be half solved. In addition, there will be the added benefit of easy communication between local libraries for ILL and other purposes (why not electronic mail for our scientists?). Scientific network development will really take off only when S&T institutions or STI libraries are connected by cheap and reliable data communication facilities. In terms of science policy, network development is a very desirable objective, being the decentralized solution to the problem of critical mass. The difficulty is the existing telecommunication network. Most probably it will have to be bypassed. But a specialized data network will be

difficult to justify only for library use which will be very light, at least in the beginning. One possibility is that of combining forces with computer centres in the universities to establish a dedicated academic network. The STI community may consider early participation in the planning of such a network through a body such as the Computer and Information Technology Council (CINTEC).

Equipment for a pilot project that could give the STI community a running start in computer networking by linking up the computers of a few STI libraries with high communication levels is now available through the Arthur C. Clarke Centre for Modern Technologies. The equipment is the Electronic Mailbox, a special modem developed by Unesco for low quality telecommunications networks, costing around Rs 15,000. The CRI library and the PGIA library, which have high external communication levels, appear to be the most appropriate sites for such a project.

Notes

1. The key works are Daniel Bell, The Coming of Post-Industrial Society: A Venture in Social Forecasting (New York: Basic Books, 1973); Fritz Machlup, Knowledge: Its Creation, Distribution and Economic Significance, 3 vols. (Princeton NJ: Princeton University Press, 1980-84); and Simon Nora and Alain Minc, The Computerization of Society (Cambridge MA: MIT Press, 1980) [original French version, 1978].

2. William H. Melody, "The Information Society: Implications for Economic Institutions and Market Theory," Journal of Economic Issues, 19(2), June 1985, pp. 523-39.

3. It is recognized that the Unesco definition is broad, "covering the documentary materials and tools needed for scientific procedure in all the sciences--not only in the natural sciences--and the data of all kinds which that procedure brings into use." --Main Working Document: Intergovernmental Conference on Scientific and Technological Information for Development [UNISIST II], PGI-79/CONF.201/COL.5, (Paris: Unesco, April 1979), p. 36. However, this study focusses on the natural sciences, in line with the prevalent Sri Lankan usage.

4. See, R.O.B. Wijesekera, "Scientific Research in a Small Developing Nation -- Sri Lanka," Economic Review, June 1976, pp. 9-12; Marina de Silva, "Science, Policy and Development. Aspects of Science and Policy in a Developing Country: A Case Study," M.Sc. thesis, Victoria University of Manchester, 1975; and generally, Susantha Goonatilake, Aborted Discovery: Science and Creativity in the Third World (London: Zed, 1984).

5. Richard de Gennaro, "Shifting Gears: Information Technology and the Academic Library," in Libraries and Information Science in the Electronic Age, ed. Hendrik Edelman (Philadelphia PA: ISI Press, 1986), p. 25.

6. Rohan Samarajiwa, "New Technologies in Scientific Communication," Sri Lanka Library Review (new series), vol. 4 (forthcoming, 1987); Stephen Schwartz, Developing Scientific and Technical Information Services in Sri Lanka, Report from a Mission to the National Science Council in the Period December 1, 1978 - February 13, 1979, FMR/PGI/79/234 (UNDP), (Paris: Unesco, 1979), p. 60. See also, N.U. Yapa, "Use of Secondary Information Services in Developing Countries with Special Reference to Sri Lanka," in Delivering Information to Users: Products, Packages and Promotions, Proceedings of the Eighth General Assembly and Congress of the FID/CAO, Melbourne, 23-28 November 1984 (Camberwell, Victoria: FID/CAO Committee, 1985), p. 170.

7. Schwartz, S&T Information Services in Sri Lanka, p. 60.

8. "[T]he maintenance of the [telephone] system is at a very unsatisfactory level with an average failure rate higher than 38 per

100 subscribers in the high density area of the Colombo region." -- National Planning Division, Public Investment 1985-1989, p. 116.

9. Information from Department of Telecommunications, September 1986.

10. Confirmed by interviews with telecommunication engineers by the Investigator in 1986, and by N.U. Yapa in 1987 August.

11. L.E. Samarasinghe, "Ceylon National Scientific and Technical Documentation Centre," Serial No. 1159/BMS.RD/DBA (Paris: Unesco, March 1969). See generally, Schwartz, S&T Information Services in Sri Lanka, pp. 54-55; Nimala R. Amarasuriya, "Meeting the Need for Scientific and Technical Information in Sri Lanka," Information Development, 2(1), January 1986, pp. 38-44.

12. Samarasinghe, "S&T Documentation Centre," pp. 12-13.

13. Ibid., p. 19.

14. National Science Council of Sri Lanka, Sri Lanka Scientific and Technological Information Centre, UNDP Project Proposal SRL/77/004/B.01/B, Colombo, 1977.

15. Interview, N.U. Yapa, Director - Information, NARESA, 22 July 1987.

16. Schwartz, S&T Information Services in Sri Lanka; Unesco-UNDP, Sri Lanka Scientific and Technological Information Centre (SLSTIC). Project Findings and Recommendations, Report FMR/PGI/OPS/83/240 (UNDP) (Paris: Unesco, March 1983).

17. Interview, N.U. Yapa, 22 July 1987.

18. Amarasuriya, Meeting the Need; N.U. Yapa, "Scientific and Technical Information Services in Sri Lanka: An Overview," background paper for Unesco-NARESA National Seminar on Scientific and Technical Information Policy, 20-21 October 1986, (mimeo.); Lionel R. Amarakoon, "Health Sciences Libraries in Sri Lanka: A Research Study," (mimeo.) (Kalutara: NIHS Library and Documentation Centre, January 1985); M.J.C. Perera, "Agricultural Information Services with Special Reference to AGRINET in Sri Lanka," manuscript (Lunuwila: Coconut Information Centre, 1987); S. Korale, "Resource Sharing: HeLLIS Sri Lanka Experience," Information Development (1987, forthcoming); and interviews.

19. Recent studies of the information seeking behaviour of Sri Lankan scientists are, Iranganie Mudannayake, "Information Needs and Information Practices of Agricultural Scientists in Sri Lanka," M.L.S. Special Problem, University of Philippines Diliman, 1987; and Dilmani Warnasuriya, "Mini Survey of the Use of the CISIR Library," Sri Lanka Library Review (n.s.), 1(1), March 1985, pp. 31-44.

20. The STI community has responded to Schwartz's plea for the systematic collection of library statistics as a precondition for informed STI policy making [S&T Information Services in Sri Lanka, p.

24] and considerable progress has been made, but much more remains to be done in increasing the reliability and comparability of data -- see, notes to Appendix I.

21. Beth Krevitt Eres and K.T. Bivins Noerr, "Access to Primary and Secondary Literature from Peripheral or Less Developed Countries," Journal of the American Society for Information Science, 36(3), (1985), pp. 184-91; Yapa, "Use of Secondary Information Services."

22. M.A.P. Senadhira, "The Scientist, Scientific Information, and the Library," Vidurava, 3(1), 1978, p. 1.

23. Yapa, "Use of Secondary Information Services," pp. 170-71.

24. The term is borrowed from the film industry which uses it to describe the physical movement of one film reel from theater to theatre for exhibition.

25. A peculiarity of human behaviour, whereby demand increases when a shortage is perceived. All rationing schemes have to make allowance for a rise in demand by those who would be marginal consumers in conditions of plenty.

26. Interview, M.J.C. Perera, Librarian, CRI, 04 August 1987.

27. Interview, N.U. Yapa, 22 July 1987.

28. CISIR, Information Services Section, Annual Report 1986, pp. 12-14.

29. Interview, W.A.M. Perera, Librarian, Central Library, Department of Agriculture, 10 August 1987.

30. Interview, S. Korale, Assistant Librarian, Faculty of Medicine, University of Colombo [HeLLIS focal point], 27 August 1987.

31. Mya Tu, et al., "HeLLIS Network Survey 1984: A Five Year Evaluation of HeLLIS Network activities in WHO South East Asian Region," SEA/HLT/23, (New Delhi: WHO SEARO, 1986).

32. Interviews at research institutes and response to questionnaire from the Medical Faculty Library of the University of Jaffna.

33. M.J.C. Perera, presentation on AGRINET at SLSTINET meeting, 15 November 1985.

34. Interviews, S. Rubasingham, Librarian, University of Moratuwa, 25 August 1987; and P. Vidanapathirana, Senior Assistant Librarian, University of Sri Jayawardanapura, 31 August 1987.

35. Interview, S. Rubasingham, 25 August 1987.

36. CISIR, Information Services Section, Annual Report 1986, pp. 7-8.

37. Ibid.

38. One researcher in the geochemistry/environmental science area stated that he has a core network of twelve foreign researchers with whom he is in contact at least once every three months. He sends his reprints to them and receives theirs in return. He perceives the network more as an information network than as a research network.

39. Leslie Gunatilake, comments on "Chemical Information: User's Point of View," Chemical Information Seminar, Institute of Chemistry, Ceylon, 28 February 1986, Colombo.

40. An active researcher in the area of tissue culture reported receiving such specialized support from the IBPGR [International Board for Plant Genetic Resources] database. Another, working on a particular family of fish, relied on documents from an annual conference that brought together almost all the researchers in the area.

41. Samarasinghe, S&T Documentation Centre, p. 13.

42. CDS-ISIS appears to have become the de facto library standard in Sri Lanka, with almost half the libraries with computers or hoping to acquire them within the coming year decided on CD-ROM, and a number of others thinking of switching -- questionnaire responses and interviews.

43. Interview, L.R. Amarakoon, National Institute of Health Sciences Library, 03 August 1987.

44. Interview with compiler, N.A.W.A.T. Alwis, Faculty of Engineering Library, University of Peradeniya, 10 August 1987.

45. Interview, S.G.S. Yapa, 24 August 1987.

46. Interview, L.R. Amarakoon, 03 August 1987; Questionnaire response, University of Peradeniya Medical Library.

47. The average turnaround time for ILL in the US is reported to be nearly two weeks. -- John Budd, "Interlibrary Loan Service: A Study of Turnaround Time," RQ, 26(1), Fall 1986, pp. 75-80 [LISA 87/3106]. Given the size of the country and the relatively better service provided by the Department of Posts, Sri Lanka may aim for 5 days.

48. Interview, N.U. Yapa, 01 November 1985.

49. Leslie Gunatilake, comments on "Chemical Information: User's Point of View," Chemical Information Seminar, Institute of Chemistry, Ceylon, 28 February 1986, Colombo.

50. Senadhira, "Scientist, Scientific Information and Library," p. 3.

51. S&T Information Services in Sri Lanka, pp. 62-63.

52. S. John Teague, Microform, Video and Electronic Media Librarianship (London: Butterworths, 1985), pp. 8-9.

53. Allen Kent, "Let the Chips Fall Where They May," in Libraries in the Electronic Age, p. 89; Donald Newman, "Dialogue on Dialog: Interview with Roger Summit," Wilson Library Bulletin, January 1986, p. 22.

54. Nancy K. Herther, "CD ROM Technology: A New Era for Information Storage and Retrieval?" Online, 1985 November, p. 17.

55. Teague, Microform Librarianship, pp. 20-22; p. 142.

56. Paul M. Artlip, "How to Choose the Right Media: Optical, Magnetic or Microfilm," Journal of Information and Image Management, September 1985, p. 17.

57. Teague, Microform Librarianship, p. 17.

58. See, John C. Lacy, "Microfilm and the Future: Market Opportunities and Directions," Journal of Information and Image Management, June 1986, pp. 31-33, 41; Artlip, "How to Choose the Right Media," September 1985, pp. 15-17, 21, 29.

59. Information provided by Mr Aziz of Chitra Foto, a major microform equipment supplier.

60. Interview, M.J.C. Perera, 04 August 1987.

61. Microform Librarianship, p. 39, p. 79.

62. Interview, C. Nethsinghe, 20 August 1987.

63. Samarasinghe, National S&T Documentation Centre, p. 19.

64. N.U. Yapa, comments at SLSTINET meeting, 15 November 1985.

65. Interview, W.A.M. Perera, 10 August 1987.

66. Jeffery K. Pemberton and Jean-Paul Emard, "Dialog in 1984: An Interview with Roger K. Summit," Online, 8(2), March 1984, p. 16.

67. The only regular online user in Sri Lanka, the Sri Lanka Business Development Centre (SLBDC) is on such a subscription plan -- interview, Sisira Ratnayake, Consultant Engineer, 26 August 1987. The data network component was calculated for the present report on the basis of USD 16 per hour from Singapore, and constitutes a ceiling figure.

68. Carol Tenopir, "Full-text Databases," in Annual Review of Information Science and Technology 19, ed. Martha Williams (White Plains NY: Knowledge Industry Publications, 1984), p. 223.

69. Loretta Caren and Arleen Somerville, "Online versus Print Sources in Academic Scientific and Technical Libraries: Supplement or Replacement?" Scientific and Technical Libraries, 6(4), 1986, p. 51-52.

70. Dialog offers a discount of about 20 per cent on 300 or more SDIs stored under one password -- Dialog Information Services, Inc., Price List, April 1987. Generally, "SDI: Tracking the Latest Research," Chemical Journals Online Bulletin, 2(1), February 1987, pp. 2-3.

71. Harry Collier, "Optical Publishing: A Who-is-Doing-What Appraisal," Electronic Publishing Review, 5(4), 1985, p. 248.

72. Information gathered from Gayathri Abeydeera, Deputy Executive Director (Information), SLBDC, and personal knowledge.

73. Interview, Ramya de Silva, Documentalist, International Irrigation Management Institute, 11 August 1987.

74. Rohan Samarajiwa and Nihal Kularatna, "Towards a Data Communication Network for Sri Lanka: A Four-Phase Project with Priority for Scientific Uses," (February 1986); Samarajiwa, "Computer-Based Scientific Information System at the Institute of Fundamental Studies Sri Lanka: Pilot Project," (March 1986); Samarajiwa, "Final Report -- Planning Phase," (July 1986). All reports available from Investigator.

75. R. Barrett, "Development and Application of the Philips CD-ROM," British Library R&D Report 5853, December 1984; Helen A. Gordon, "Digital Audio Disc Corporation . . . An Interview with Executives of a New Sony Subsidiary -- A Manufacturer of CDROM," Online, 1986 November, pp. 61-66.

76. However, for a report of an error caused by finger marks and dust, see, David Mutter, "The MicroVAX II and CD-ROM -- An Evaluation," Information Media and Technology, 20(1), January 1987, p. 33.

77. Herther, "CD ROM Technology," p. 27, citing Hitachi; and Richard Kemp, "Compact Cambridge-Medline: A Review of the Medline CD-ROM," Electronic and Optical Publishing Review, 7(1), March 1987, pp. 27-28.

78. See for example, Victoria Ann Reich and Melissa Ann Betcher, "Library of Congress Staff Test Optical Disk System," College and Research Libraries, July 1986, pp. 385-91; Ian C. Edwards, "Optical Storage Developments -- Write-Once Media," Electronic and Optical Publishing Review, 7(1), March 1987, pp. 16-20.

79. Herther, "CD ROM Technology," p. 19, p. 27; Barrett, "Philips CD-ROM," p. 6.

80. Collier, "Optical Publishing: Appraisal," p. 246.

81. Problems with telecommunications are not a monopoly of the Third World. See, "Data Calls Disastrous," Information World Review, July/August 1987, p. 1 -- " Three out of ten dial-up data calls fail, according to a recent survey."

82. Gordon, "Digital Audio Disc Corporation," p. 65.

83. For a critical and illuminative view of CD-ROM, see Stephen E. Arnold, "A Baker's Dozen of CD-ROM Myths," Electronic and Optical Publishing Review, 7(2), June 1987, pp. 58-63.

84. Information World Review, various issues; Information Media and Technology, 20(1), January 1987; Jeffrey Bairstow, "CD-ROM: Mass Storage for the Mass Market," High Technology, October 1986, p. 48; and product information.

85. Schwartz recommended in 1979 that SLSTIC "introduce computerized current awareness and retrospective searches by bilateral agreement with an external Information and Documentation Centre." -- S&T Information Services in Sri Lanka, p. 53.

86. 5,523 was the number provided by NARESA in 1984 -- Amarasuriya, S&T Information in Sri Lanka," p. 38.

87. For details of Indian developments see, "Information Shops Keyed Up," India Today, 30 April 1986, p. 77.

88. Zhang Jiaxiang, Wang Taihe, and Jin Yanxia, "An International Online Information Retrieval Service in China," IFLA Journal, 12(4), 1986, pp. 321-24.

89. Richard De Gennaro, "Shifting Gears: Information Technology and the Academic Library," in Libraries in the Electronic Age, pp. 32-33.

PRICE TRENDS OF SELECTED A&I JOURNALS IN SRI LANKAN LIBRARIES[1]

Journal	Library[2]	1982	1983	1984	1985	1986	1987[3]	Ulrich
Abs Ent [BIOSIS]	UP	--	3,592	3,592	5,730	--	5,884	4,950
Abs Trop Agri	UP[4]	--	--	4,206	3,771	4,945	5,577	3,600
Anal Abs [RSC]	CISIR	--	8,352	--	--	11,520	12,624	12,750
	CRI	--	9,187	10,058	11,057	10,058	15,906	--
	TRI	--	--	--	--	--	7,890	--
Ani Breed Abs [CAB]	VRI	--	5,791	5,791	5,791	6,970	--	9,900
Arch Per Indx [RIBA]	UM	--	2,200	2,400	3,000	--	--	3,840
Aq Sc Fish Abs [CSA]	NARA	--	--	--	21,195	41,425[5]	--	15,660
	UC	--	--	--	--	--	13,950	--
Biblio Agri	UP	--	--	--	--	13,650	18,864	--
Biocon N Info [CAB]	CRI	--	2,006	2,160	2,640	2,400	3,548	2,760
Bio Abs [BIOSIS]	CRI	--	71,791	89,520	disctd.	--	--	89,550
	UP	--	--	--	--	83,250	70,070	--
Chem Abs (3 sect.)	UP	--	75,600	78,300	99,000	108,000	117,000	108,000
Chem Abs (Compl.)	CISIR	190,800	209,850	225,000	255,000	276,000	324,000	276,000
Comp & Cont Abs	UM	--	41,500	45,500	49,250	--	--	23,250
CC Agr/Bio/Env [ISI]	UP	--	--	--	13,680	7,378	--	8,160
	UC	--	--	--	--	--	10,440	--
	USJ	--	--	--	--	--	--	--
	CRI	--	--	--	15,600	11,811	14,111	--
CC Eng [ISI]	UP	--	--	9,300	9,750	10,042	10,042	8,160
	UM	--	7,460	7,750	8,125	--	--	--
CC Life Sci [ISI]	UP	--	--	10,350	11,250	11,250	11,820	8,160
	UC	--	--	9,900	8,060	8,100	--	--
	USJ	--	--	--	--	--	10,440	--
CC Phy/Chem/Earth	UP	--	9,000	9,300	9,750	9,750	10,440	8,160
	UC	--	--	8,791	--	--	10,440	--
	USJ	--	--	--	--	--	11,820	--
Cur Tech Indx	BC/C	--	11,520	11,664	13,824	--	--	15,540
Dairy S Abs [CAB]	VRI	4,700	4,944	5,196	disctd.	--	--	10,260
	CISIR	2,940	3,290	3,248	--	--	--	--
Diss Abs [UMI]	SLSTIC	--	6,150	6,150	6,750	disctd.	--	4,650
Eng Index [EIC]	CISIR	17,700	22,800	24,000	24,000	--	27,000	50,400
Fld Crop Abs [CAB]	CISIR	5,904	6,192	6,480	8,160	8,640	8,976	12,840
	UP	--	--	--	--	--	8,976	--
	DAG	--	--	--	--	--	8,640	--
Food S T Abs [CAB]	CISIR	22,500	23,700	24,900	25,800	33,120	44,448	26,700
	TRI	--	--	--	--	--	27,780	--
For Prds Abs [CAB]	DF	--	3,840	3,840	3,840	--	--	5,250
	DAG	--	--	--	--	--	3,840	--
Forestry Abs [CAB]	DF	--	7,680	7,680	7,680	--	--	10,800
	DAG	--	--	--	--	--	7,680	--
Genetics Abs [CSA]	USJ	--	5,617	8,868	9,597	13,990	13,500	16,890
Helminth Abs-A [CAB]	VRI	--	4,887	4,887	4,887	--	--	8,400
	UP	--	3,740	3,927	4,840	--	6,442	--
	DAG	--	--	--	--	--	5,856	--

Journal	Library	1982	1983	1984	1985	1986	1987	Ulrich
Herbage Abs [CAB]	RRI[6]	3,528	--	6,150	6,926	7,353	--	7,350
	DAG	--	--	--	--	--	5,136	--
	UP	--	--	--	--	--	5,328	--
Horticult Abs [CAB]	CISIR	6,384	6,720	7,056	9,120	9,696	10,080	13,950.
	RRI	6,703	--	11,594	13,320	13,534	8,459	--
	UP	--	--	--	--	--	9,491	--
Indx Medic [NLM]	UC	7,312	7,312	6,299	--	5,812	--	4,830
	UP	--	--	--	--	--	5,790	--
	UJ	--	--	--	--	--	14,850[7]	--
Indx Medic (Cum)	UP	--	--	7,110	11,040	8,100	8,640	--
	UC	--	--	--	--	--	9,750	--
Indx Dent Lit [ADA]	UP	--	3,892	3,920	3,920	--	4,500	3,750
Irri Power Abs	UP	--	--	1,973	2,595	2,273	3,021	1,500
LISA [LAP]	SLSTIC	--	6,816	7,104	7,680	8,304	9,024	9,330
Metals Abs [ASM]	UM	--	29,875	32,500	35,000	--	--	33,000
Micbio Abs-A [CSA]	CISIR	7,200	15,360	9,970	8,339	disctd.	--	13,830
Nutr Abs Rev-B [CAB]	UP	--	--	3,978	4,042	5,192	5,514	8,400
Pkg S&T Abs [IFIS]	CISIR	--	--	6,720	6,720	6,720	8,000	8,000
Physics Abs [INSPEC]	USJ	--	23,184	26,015	26,015	--	44,880	50,100
	UK	--	--	--	--	--	47,124	--
	UC	--	--	--	--	--	44,800	--
Phys Rev-B [APS]	UP	--	--	19,980	23,700	26,970	32,550	25,500
RAPRA Abs	CISIR	24,288	26,208	28,848	31,440	--	34,272	20,250
	IDB	--	16,457	18,581	23,143	--	--	--
Sci Cit Indx [ISI]	SLSTIC	--	73,500	78,000	87,000	93,000	--	186,000
Soil Fert [CAB]	RRI	6,048	--	11,119	12,521	13,320	8,325	13,350
	UP	--	--	--	--	--	9,744	--
	DAG	--	--	--	--	--	8,880	--
Vir Abs [CSA]	UP	--	5,741	5,870	11,040	12,150	12,630	13,890
Weed Abs [CAB]	RRI	3,024	--	5,239	5,861	6,234	3,896	6,300
	DAG	--	--	--	--	--	4,320	--
	UP	--	--	--	--	--	4,512	--
Rs 0-15,000 Median Prices		5,978	5,885	6,299	7,680	8,472	8,640	
Rs 15,000-50,000 Med. Pr.		22,500	23,700	24,900	25,800	33,120	38,500	

Source: Responses to SLSTIC questionnaires, 1986 and 1987; Interviews.

Notes

1. (a) Selection criterion was data availability, hence the median values have limited, illustrative value only. (b) There was no uniformity in reporting prices, either as to source or currency. It may be advisable to specify invoice prices in future questionnaires. Price data from Ulrich's International Periodicals Directory 1986-1987, 25th edition, 2 vols (New York: R.R. Bowker, 1986) is given as a benchmark. (c) The following exchange rates have been used for conversion: SLR 30 = USD 1; SLR 48 = BP 1; SLR 1 = IR 2.1. There may be minor discrepancies. (d) Only price data sets of three or more have been used in the calculations of median values for the different price groups.

2. SLSTINET identifiers have been used.

3. The data in this column is doubtful as the questionnaire was ambiguous on the year referred to.

4. PGIA is listed under UP.

5. Possible conversion error. 1986 amount only was given in IR.

6. All RRI subscription prices for 1982-86 were taken directly from invoices. They vary significantly from the 1987 data supplied by the RRI as well as from parallel subscriptions.

7. Possibly combined figure for Index Medicus and the cumulation.

APPENDIX II

A&I Journals in SLSTINET 91/02/27

1	CUMULATIVE INDEX MEDICUS HEALTH SCIENCES	UC/M
2	INDEX MEDICUS HEALTH SCIENCES	UC/M
3	INDEX MEDICUS FOR SEARO HEALTH SCIENCES	UC/M
4	NUTRITION ABSTRACTS & REVIEW SERIES A: HUMAN & EXPERIMENTAL HEALTH SCIENCES	UC/M
5	REVIEW OF APPLIED ENTOMOLOGY SER.B: MEDICAL & VETERINARY HEALTH SCIENCES	UC/M
6	TROPICAL DISEASES BULLETIN HEALTH SCIENCES	UC/M
7	INDEX MEDICUS HEALTH SCIENCES	UJ/M
8	QUARTERLY BIBLIOGRAPHY OF MAJOR TROPICAL DISEASES HEALTH SCIENCES	UJ/M
9	BIBLIOGRAPHY OF RESPIRATIORY INFECTIONS IN CHILDREN HEALTH SCIENCES	UJ/M
10	WHO MENTAL HEALTH PROGRAMME BIBLIOGRAPHY HEALTH SCIENCES	UJ/M
11	ABSTRACTS OF HYGIENE HEALTH SCIENCES	UJ/M
12	JANSEEN LIBRARY ABSTRACTS ON GYNAECOLOGY HEALTH SCIENCES	UJ/M
13	JANSEEN LIBRARY ABSTRACTS ON ANAESTHESIA HEALTH SCIENCES	UJ/M
14	JANSEEN LIBRARY ABSTRACTS ON PHYCHIATRY HEALTH SCIENCES	UJ/M
15	JANSEEN LIBRARY ABSTRACTS ON DERMATOLOGY HEALTH SCIENCES	UJ/M
16	JANSEEN LIBRARY ABSTRACTS ON GASTROENTEROLOGY HEALTH SCIENCES	UJ/M
17	JANSEEN LIBRARY ABSTRACTS ON ALLERGEOLOGY HEALTH SCIENCES	UJ/M
18	ABSTRACTS OF HUNGARIAN ECONOMIC LITERATURE GENERAL	CDI
19	ABSTRACTS OF SCIENCE & TECHNOLOGY IN JAPAN GENERAL	CDI
20	AID RESEARCH & DEVELOPMENT ABSTRACTS GENERAL	CDI
21	RENEWABLE ENERGY INDEX ENERGY	CDI
22	INDIAN DISSERTATION ABSTRACTS GENERAL	CDI
23	INDUSTRIAL DEVELOPMENT ABSTRACTS GENERAL	CDI
24	INTERNATIONAL DEVELOPMENT ABSTRACTS GENERAL	CDI
25	INTERNATIONAL DEVELOPMENT INDEX GENERAL	CDI
26	NEPO ABSTRACTS GENERAL	CDI
27	APSDEP DOCUMENTATION BULLETIN GENERAL	DL
28	CIS ABSTRACTS GENERAL	DL
29	CONDITIONS OF WORK DIGEST MATHEMATICS	DL
30	INDIAN DISSERTATION ABSTRACTS GENERAL	DL
31	INTERNATIONAL LABOUR DOCUMENTATION MATHEMATICS	DL
32	RESEARCH ABSTRACTS QUARTERLY GENERAL	DL
33	ADOPT - ASIAN PACIFIC & WORLDWIDE DOCUMENTS ON POPULATION TOPICS HEALTH SCIENCES	DL
34	EDUCATIONAL TECNOLOGY ABSTRACTS GENERAL	UO
35	ASSET GENERAL	UO
36	IRRIGATION AND DRAINAGE ABSTRACTS AGRICULTURE	IMII
37	QUARTERLY BIBLIOGRAPHY OF MAJOR TROPICAL DISEASES HEALTH SCIENCES	NIHS
38	ASIAN-PACIFIC & WORLD WIDE DOCUMENTS ON POPULATION TOPICS HEALTH SCIENCES	NIHS
39	ACCOUNTS DIGEST MATHEMATICS	SLID
40	ADMINISTRATIVE SCIENCE QUARTERLY MATHEMATICS	SLID
41	ADMINISTRATIVE SCIENCE REVIEW MATHEMATICS	SLIDA
42	WORLD EXECUTIVE DIGEST MATHEMATICS	SLIDA
43	CALIFORNIA MANAGEMENT REVIEW MATHEMATICS	SLIDA
44	ECONOMIC REVIEW (ENG) MATHEMATICS	SLIDA
45	INDUSTRIAL & LABOUR RELATIONS REVIEW MATHEMATICS	SLIDA
46	PUBLIC PRODUCTIVITY REVIEW MATHEMATICS	SLIDA
47	WORLD BANK ECONOMIC REVIEW MATHEMATICS	SLIDA
48	WORLD AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY ABSTRACTS AGRICULTURE	DCS
49	ANALYTICAL ABSTRACTS CHEMISTRY & PHYSICS	CRI
50	BIOCONTRAL NEWS & INFORMATION BIOLOGY	CRI
51	CURRENT CONTENTS GENERAL	CRI
52	HERBAGE ABSTRACTS AGRICULTURE	CRI
53	HORTICULTURAL ABSTRACTS AGRICULTURE	CRI
54	INDIAN SCIENCE ABSTRACTS GENERAL	CRI
55	PLANT BREEDING ABSTRACTS BIOLOGY	CRI

56	FOOD TECHNOLOGY ABSTRACTS CHEMISTRY & PHYSICS	CRI
57	SOILS & FERTILIZERS AGRICULTURE	CRI
58	ABSTRACTS OF SCIENCE & TECHNOLOGY IN JAPAN GENERAL	CRI
59	WEED ABSTRACTS AGRICULTURE	CRI
60	FIELD CROPS ABSTRACTS AGRICULTURE	CRI
61	ECOLOGY ABSTRACTS ENVIRON. SCIENCES	CRI
62	ANIMAL BEHAVIOUS ABSTRACTS AGRICULTURE	CRI
63	CHEMORECEPTIONS ABSTRACTS CHEMISTRY & PHYSICS	TRI
64	ENTOMOLOGY ABSTRACTS BIOLOGY	TRI
65	FOOD SCIENCE & TECHNOLOGY ABSTRACTS CHEMISTRY & PHYSICS	TRI
66	FIELD CROPS ABSTRACTS AGRICULTURE	TRI
67	HORTICULTURAL ABSTRACTS AGRICULTURE	TRI
68	PLANT BREEDING ABSTRACTS BIOLOGY	TRI
69	WEED ABSTRACTS AGRICULTURE	TRI
70	HELMINTHOLOGICAL ABSTRACTS BIOLOGY	TRI
71	ANALYTICAL ABSTRACTS CHEMISTRY & PHYSICS	TRI
72	AGRINDEX AGRICULTURE	TRI
73	APPLIED MECHANICAL REVIEWS ENG. & TECH.	TRI
74	CURRENT CONTENTS : ENGINEERIGN, TECHNOLOGY & APPLIED SCIENCES ENG. & TECH.	TRI
75	INTERNATIONAL JOUR. OF ROCK MECH. & MINING SCIE. & GEOMECHANICS ABSTC. ENG. & TECH.	U
76	IRRIGATION & POWER ABSTRACTS ENG. & TECH.	UP/E
77	THORITICAL CHEMICAL ENGINEERING ABSTRACTS CHEMISTRY & PHYSICS	UP/E
78	CRRI ROAD ABSTRACTS CHEMISTRY & PHYSICS	UP/E
79	TICST ABSTRACTS - ELECTRONICS & COMMUNICATIONS CHEMISTRY & PHYSICS	UP/E
80	TICST ABSTRACTS - ENERGY TECHNOLOGY ENERGY	UP/E
81	RENEWABLE ENERGY - DIRECTORY ENERGY	UP/E
82	RENEWABLE ENERGY - INDEX ENERGY	UP/E
83	ABSTRACTS OF BULGARIAN SCIENTIFIC MEDICAL LITERATURE HEALTH SCIENCES	UP/M
84	ABSTRACTS OF ENTOMOLOGY BIOLOGY	UP
85	ABSTRACTS ON TROPICAL AGRICULTURE AGRICULTURE	UP
86	BIOLOGICAL ABSTRACTS BIOLOGY	UP
87	CHEMICAL ABSTRACTS - BIOCHEMISTRY CHEMISTRY & PHYSICS	UP
88	CHEMICAL ABSTRACTS - ORGANIC CHEMISTRY CHEMISTRY & PHYSICS	UP
89	CHEMICAL ABSTRACTS - PHYSICAL INORGANIC & ANALYTICAL CHEMISTRY CHEMISTRY & PHYSICS	UP
90	CUMULATED INDEX MEDICUS HEALTH SCIENCES	UP/M
91	CURRENT CONTENTS - ENGINEERING ENG. & TECH.	UP
92	CURRENT CONTENTS - LIFE SCIENCE BIOLOGY	UP/M
93	CURRENT CONTENTS - PHYSICAL, CHEMICAL & EARTH SCIENCES CHEMISTRY & PHYSICS	UP
94	DAIRY SCIENCE ABSTRACTS AGRICULTURE	UP/M
95	CURRENT CONTENTES - LIFE SCIENCE HEALTH SCIENCES	UP
96	CURRENT CONTENTS - LIFE SCIENCE HEALTH SCIENCES	UP
97	CURRENT CONTENTS - PHYSICAL, CHEMICAL & EARTH SCIENCES CHEMISTRY & PHYSICS	UP
98	DENTAL ABSTRACTS HEALTH SCIENCES	UP/M
99	FIELD CROPS ABSTRACTS AGRICULTURE	UP
100	FOOD TECHNOLOGY ABSTRACTS CHEMISTRY & PHYSICS	UP
101	HELMINTHOLOGICAL ABSTRACTS SERIES A BIOLOGY	UP
102	HERBAGE ABSTRACTS AGRICULTURE	UP
103	HORTICULTURAL ABSTRACTS AGRICULTURE	UP
104	IMMUNOLOGY ABSTRACT AGRICULTURE	UP
105	INDEX MEDICUS MATHEMATICS	UP/M
106	INDEX TO DENTAL LITERATURE IN THE ENGLISH LANGUAGE HEALTH SCIENCES	UP/M
107	NUTRITION ABSTRACTS REVIEWS SERIES B, LIVESTOCKS HEALTH SCIENCES	UP
108	PHYSICAL REVIEW - SECTION B CHEMISTRY & PHYSICS	UP
109	PLANT BREEDING ABSTRACTS BIOLOGY	UP
110	THAI ABSTRACTS - SERIES A SCIENCE & TECHNOLOGY GENERAL	UP

111 THESIS ABSTRACTS OF HARYANA AGRICULTURAL UNIVERSITY AGRICULTURE UP
112 WEED ABSTRACTS AGRICULTURE UP
113 ABSTRACTS OF SCIENCE & TECHNOLOGY IN JAPAN GENERAL RRI
114 ABSTRACTS ON TROPICAL AGRICULTURE AGRICULTURE RRI
115 FIELD CROP ABSTRACTS AGRICULTURE RRI
116 HORTICULTURAL ABSTRACTS AGRICULTURE RRI
117 INDIAN SCIENCE ABSTRACTS GENERAL RRI
118 KOREAN SCIENTIFIC ABSTRACTS GENERAL RRI
119 PLANT BREEDING ABSTRACTS BIOLOGY RRI
120 REVIEW OF PLANT PATHOLOGY BIOLOGY RRI
121 SOILS & FERTILIZERS AGRICULTURE RRI
122 WEED ABSTRACTS AGRICULTURE RRI
123 INIS ATOMINDEX NUCLEAR SCIENCE AEA
124 AQUATIC SCIENCE & FISHERIES ABSTRACTS AGRICULTURE UC/M
125 CURRENT CONTENTS (AGRICULTURE, BIOLOGY & ENVIRONMENTAL SCIENCE) AGRICULTUREUC/M
126 CURRENT CONTENTS (LIFE SCIENCES) BIOLOGY UC/M
127 PHYSICS ABSTRACTS CHEMISTRY & PHYSICS UC/M
128 ABSTRACTS OF SCIENCE & TECHNOLOGY OF JAPAN GENERAL PGIA
129 ABSTRACTS ON TROPICAL AGRICULTURE AGRICULTURE PGIA
130 BIBLIOGRAPHY OF AGRICULTURE AGRICULTURE PGIA
131 BIOLOGICAL ABSTRACTS BIOLOGY PGIA
132 BULLETIN OF ENTOMOLOGICAL RESEARCH BIOLOGY PGIA
133 CURRENT CONTENTS : AGRICULTURE, BIOLOGY & ENVIRONMENTAL SCIENCE AGRICULTUREPGIA
134 FIELD CROP ABSTRACTS AGRICULTURE PGIA
135 FOOD TECHNOLOGY ABSTRACT CHEMISTRY & PHYSICS PGIA
136 HELMINTHOLOGICAL ABSTRACTS BIOLOGY PGIA
137 HERBAGE ABSTRACTS AGRICULTURE PGIA
138 HORTICULTURAL ABSTRACTS AGRICULTURE PGIA
139 INDEX OF FUNGI AGRICULTURE PGIA
140 NUTRITION ABSTRACTS AND REVIEWS HEALTH SCIENCES PGIA
141 PLANT BREEDING ABSTRACTS BIOLOGY PGIA
142 REVIEW OF APPLIED ENTOMOLOGY BIOLOGY PGIA
143 REVIEW OF PLANT PATHOLOGY BIOLOGY PGIA
144 RICE ABSTRACTS AGRICULTURE PGIA
145 SOILS AND FERTILIZERS AGRICULTURE PGIA
146 WEEDS ABSTRACTS AGRICULTURE PGIA
147 WORLD AGRICULTURAL ECONOMICS & RURAL SOCIETY ABSTRACTS AGRICULTURE PGIA
148 INDEX MEDICUS HEALTH SCIENCES PGIM
149 ANIMAL BREEDING ABSTRACTS AGRICULTURE USJ
150 CURRENT CONTENTS : AGRICULTURE, BIOLOGY & ENVIRONMENTAL SCIENCES AGRICULTUREUSJ
151 GURRENT CONTENTS : PHYSICAL, CHEMICAL & EARTH SCIENCES CHEMISTRY & PHYSICSUSJ
152 GENETICS ABSTRACTS BIOLOGY USJ
153 PHYSICS ABSTRACTS CHEMISTRY & PHYSICS USJ
154 GHROMATOGRAPHY ABSTRACTS CHEMISTRY & PHYSICS SLSI
155 GAS & LIQUID CHROMATOGRAPHY ABSTRACTS CHEMISTRY & PHYSICS SLSI
156 A.C.U. BULLETIN OF CURRENT DOCUMENTATION ENG. & TECH. UM
157 A.G.E. REFDEX ENG. & TECH. UM
158 A.P.I. ARCHITECTURAL PERIODICALS INDEX ENG. & TECH. UM
159 A.S.C.E. ANNUAL COMBINED INDEX ENG. & TECH. UM
160 A.S.C.E. PUBLICATIONS INFORMATION ENG. & TECH. UM
161 ABSTRACTS OF SCIENCE & TECHNOLOGY IN JAPAN : ELECTRONIC & COMMERCE ENG. & TECH.UM
162 ABSTRACTS OF SCIENCE & TECHNOLOGY IN JAPAN : ENERGY TECHNOLOGY ENERGY UM
163 BRITISH BOOK NEWS GENERAL UM
164 BRITISH CERAMIC ABSTRACTS CHEMISTRY & PHYSICS UM
165 BRITISH REPORTS, TRANSLATIONS AND THESES GENERAL UM

166 BUILDING RESEARCH ESTABLISHMENT DIGEST GENERAL UM
167 CEGB ABSTRACTS ENG. & TECH. UM
168 CANADIAN BUILDING DIGEST ENG. & TECH. UM
169 CERAMIC ABSTRACTS CHEMISTRY & PHYSICS UM
170 COMPUTER & CONTRAOL ABSTRACTS ENG. & TECH. UM
171 CURRENT CONTENTS : ENGINEERING, TECHNICAL & APPLIED SCIENCE ENG. & TECH.UM
172 CURRENT TECHNOLOGY INDEX ENG. & TECH. UM
173 DOCUMENTED SURVEY ON METALLURGICAL DEVELOPMENTS ENG. & TECH. UM
174 ELECTRICAL & ELECTRONICS ABSTRACTS ENG. & TECH. UM
175 ENVIRONMENTAL SANITATION ABSTRACTS ENVIRON. SCIENCES UM
176 ENVIRONMENTAL SANITATION REVIEWS ENVIRON. SCIENCES UM
177 I.E.E.E. PUBLICATIONS INDEX ENG. & TECH. UM
178 I.M.M. ABSTRACTS ENG. & TECH. UM
179 INTERNATIONAL CIVIL ENGINEERING ABSTRACTS ENG. & TECH. UM
180 INT. JOUR. OF ROCK MECHANICS & MINING SC. & GEOMECHANICS ABSTRACTS EARTH SCIENCESUM
181 INTERNATIONAL TEXTILE CALENDER ENG. & TECH. UM
182 LEAD ABSTRACTS CHEMISTRY & PHYSICS UM
183 METALS ABSTRACTS CHEMISTRY & PHYSICS UM
184 MINING JOURNAL & MINING MAG. CUMULATIVE INDEX EARTH SCIENCES UM
185 NEW TECHNICAL BOOKS ENG. & TECH. UM
186 PERIODICALS OF ASIA & THE PACIFIC GENERAL UM
187 RENEWABLE ENERGY DIRECTORY ENERGY UM
188 RENEWABLE ENERGY INDEX ENERGY UM
189 SYNOPSES OF SWEDISH BUILDING RESEARCH ENG. & TECH. UM
190 TECHNICAL REVIEW ENG. & TECH. UM
191 ENVIRONMENTAL SANITATION ABSTRACTS ENVIRON. SCIENCES NWSDB
192 ZOOLOGICAL RECORD BIOLOGY NML
193 NEW ZEALAND SCIENCE ABSTRACTS GENERAL NML
194 BIBLIOGRAPHIA INVERTEBRATORUM CANADENSIUM BIOLOGY NML
195 ABSTRACTS OF BULGARIAN SCIENTIFIC LITERATURE, GEOLOGY & GEOGRAPHY EARTH SCIENCESNML
196 DAIRY SCIENCE ABSTRACT AGRICULTURE VRI
197 HERBAGE ABSTRACTS AGRICULTURE VRI
198 HELMINTHOLOGICAL ABSTRACTS SERIES A BIOLOGY VRI
199 ANIMAL BREEDING ABSTRACTS BIOLOGY VRI
200 NUITRITION ABSTRACTS HEALTH SCIENCES VRI
201 FIELD CROP ABSTRACTS AGRICULTURE DAG
202 FOREST PRODUCTS ABSTRACTS AGRICULTURE DAG
203 FORESTRY ABSTRACTS AGRICULTURE DAG
204 HELMINTHOLOGICAL ABSTRACTS BIOLOGY DAG
205 HELMINTHOLOGICAL ABSTRACTS BIOLOGY DAG
206 HERBAGE ABSTRACTS AGRICULTURE DAG
207 PLANT BREEDING ABSTRACTS BIOLOGY DAG
208 REVIEW OF APPLIED ENTOMOLOGY BIOLOGY DAG
209 REVIEW OF APPLIED ENTHOMOLOGY - B BIOLOGY DAG
210 REVIEW OF PLANT PATHOLOGY BIOLOGY DAG
211 SOILS & FERTILISERS AGRICULTURE DAG
212 WEED ABSTRACTS AGRICULTURE DAG
213 WORLD AGRICULTURAL ECONOMICS & RURAL SOCIOLOGY ABSTRACTS AGRICULTURE DAG
214 ABSTRACTS OF SCIENCE & TECHNOLOGY IN JAPAN GENERAL DAG
215 AGRINDEX AGRICULTURE DAG
216 ABSTRACTS ON TROPICAL AGRICULTURE AGRICULTURE IDB
217 COTTON AND TROPICAL FIBRES ABSTRACTS ENG. & TECH. IDB
218 FOOD SCIENCE AND TECHNOLOGY ABSTRACTS CHEMISTRY & PHYSICS IDB
219 RAPRA ABSTRACTS ENG. & TECH. IDB
220 FOOD TECHNOLOGY ABSTRACTS CHEMISTRY & PHYSICS IDB

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QUESTIONNAIRE FOR IDRC/NARESA RESEARCH PROJECT ON SRI LANKAN STI SYSTEM AND NEW TECHNOLOGIES[1]

Please take the time to answer this brief questionnaire before you leave, and return it either to Dr Samarajiwa or to Mr N.U. Yapa. It will be of great value in this study.

1. Name of library: _____

General[2] [Where you can't give an exact figure, give an estimate]

2. Number of users: researchers _____
3. others _____
4. Annual books & periodicals (B&P) budget (198_) _____
5. Periodicals budget as percentage of B&P budget ____%
6. Abstracting/indexing journals budget as % of B&P budget___%

Information on Information

7. How users obtain information on information: [tick one][3]
   Own library _54_ Other libraries _19_ Other sources _10_
8. Do you provide selective dissemination of information (SDI)?
   Yes _30__ No _28_
9. Do you distribute contents pages? Yes _36__ No _22_

Inter Library Loans

10. Estimate inter library (IL) loans requested by your library per year? [tick one]
    0 _6_ 1-25 _23 26-50 13_ 51-100 7__ More than 100 _9_
11. Estimate IL loans requested from your library per year?
    0 _13 1-25 _24 26-50 _8_ 51-100 _8_ More than 100 5__
12. How do you decide where to send ILL requests? [tick one]
    UNILIST/UNICAST 30 Personal knowledge 29 Other 8__N.A. 5____
13. Are you (or your users) satisfied with ILL system?
    Yes _46 No _8_
14. Principal cause for dissatisfaction, if any? [tick one]
    Difficulty in locating material _9__ Lack of response _8_
    Excessive time taken _5__ Other _1____N.A. _35_____
15. Does your library have its own photocopier? Yes 32 No 24
    N.A. 2

New Technology

16. Does your library have a computer now? Yes _10 No _48
17. Will you be getting one within a year? Yes _12 No _36
18. If yes to above, software is: CDS-ISIS 10_ Other _6_ N.A. 5
19. Does library have a direct telephone line? Yes _19 No _39
20. Will you be getting one within a year? Yes _6_ No _33
21. Does your library have a microfilm/fiche reader? Yes 20 No 38
22. Will you be getting one within a year? Yes _4 No 34

THANK YOU FOR YOUR TIME AND CONTRIBUTION. THE COMPLETED REPORT WILL BE SUBMITTED TO THE UNISIST COMMITTEE OF NARESA BY OCTOBER. THE FINDINGS WILL BE COMMUNICATED TO YOU AS MEMBERS OF THE STI COMMUNITY.

Dr Rohan Samarajiwa
Investigator.

Notes

1. The questionnaire was distributed at a meeting of SLSTINET on 24 July 1987 after a brief presentation on the nature and objectives of the project. A follow-up mailing was done to those librarians who had not returned the questionnaires and who had not been present. Fifty eight responses were received in time for inclusion in the cumulation given below. These, and the responses received subsequently are on file at SLISTIC. The response rate was 58%, but includes almost all the major libraries.

2. Not cumulated as responses were incomplete and not comparable.

3. The totals in questions 7 and 12 exceed 58 because respondents had ticked more than one choice.

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2. Ms Ramani Mahakumara, Clerk-Typist (in charge of interlibrary loans), Library, Rubber Research Institute, Dartonfield, Agalawatte. [In the absence of Mrs V.S. Jayaratne, Librarian]

3. Mr L.R. Amarakoon, Librarian, National Institute of Health Sciences, Kalutara.

4. Mr M.J.C. Perera, Librarian, Coconut Research Institute, Bandirippu Estate, Lunuwila.

5. Mr W.A.M. Perera, Librarian, Central Library, Department of Agriculture, Gannoruva, Peradeniya. [In the absence of Ms Gunasekera, Chief Librarian]

6. Mr N.T.S.A. Senadeera, Librarian, University of Peradeniya, Peradeniya.

7. Mr J.V. Fernando, Senior Assistant Librarian, Post Graduate Institute of Agriculture, Peradeniya.

8. Ms Iranganie Mudannayake, Assistant Librarian, Post Graduate Institute of Agriculture, Peradeniya.

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10. Ms Sriyani Perera, Assistant Librarian, Faculty of Science, University of Peradeniya, Peradeniya.

11. Ms Ramya de Silva, Documentalist, International Institute for Irrigation Management, Digana.

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13. Mr Ananda Jayawardana, Senior Assistant Librarian, Faculty of Medicine, University of Peradeniya, Peradeniya.

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18. Mrs I. Unamboowa, Director, and Mrs S.M. Tennakoon, Librarian, Information Services Division, Industrial Development Board, Katubedda, Moratuwa.

19. Mrs S. Korale, Senior Assistant Librarian, Faculty of Medicine, University of Colombo, Colombo 8.

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