RM-78-43

INTERNATIONAL DATA EXCHANGE AND THE APPLICATION OF INFORMATICS TECHNOLOGY- CRITICAL RESEARCH NEEDS

D. Penniman
A. Butrimenko
J. Page

September 1978

Preface

International data communication networks are a reality. Despite the fact that national policies on data communication activities are still evolving, international links are already being established which provide the potential for massive data exchange activities. But will this potential be realized? And, if it is, will the data exchange activities benefit the citizens of the nations involved, or will data exchange via computer communication systems only further separate countries and peoples of different technological levels, political ideologies, and social structures? There are areas such as health care, environmental monitoring, and food resource supply where international data exchange on a timely and accurate basis could be of great benefit. There are, at the same time, areas where such exchange could be used for the economic or political ends of one country or organization. While the evolving technology is a strong driving force for establishing international data exchange activities, there is a need for a systematic review of the full range of problems and pitfalls of this area.

In 1977 the International Institute for Applied Systems Analysis (IIASA) initiated an exploratory study of the potential for international data exchange activities and their incorporation of the latest in computer networking technology. (See A. Butrimenko, "International System for Scientific Data Exchange," Telecommunications Policy, March 1977, pp. 163-4 for further description of IIASA's interest in this area.) The study was exploratory in that major areas of concern were to be identified and areas of particular interest were to be selected for future study by IIASA or other organizations concerned with international data exchange.

While the evolving networking technology was one of the driving factors in initiating this study, it was apparent that non-technical factors were of equal concern in determining the conditions conducive to successful international data exchange activities. Consequently, from the outset of the study a broad perspective was incorporated which attempted to embrace all components or

factors including legal, political, regulatory, economic and social as well as technical.

The preliminary study was designed to result in a clear set of recommendations for future work at IIASA in the area of international data exchange. In addition, areas of research not to be undertaken at IIASA but to be promoted within national organizations were to be clearly specified. To accomplish these goals a select group of nineteen individuals (representing nine different countries as well as UNESCO) was organized. This group met in Toronto in August of 1977 for a one-day workshop to prepare a list of critical research issues. Participants were then queried via a follow-up mailed questionnaire in order to rank these issues. In addition, a general categorization of research areas was developed at the workshop and the follow-up questionnaire provided an opportunity for the participants to indicate relative emphasis which each category should receive in terms of research funding in the long term.

The authors hope that the results of this preliminary IIASA project presented here will stimulate research at IIASA and influence the directions of IIASA and other institutions in their future projects related to international data exchange.

David Penniman
Workshop Moderator and
Task Leader
International Data
Exchange Task
Computer Science Group
International Institute for
Applied Systems Analysis
Laxenburg, Austria

Executive Summary

During 1977 the International Institute for Applied Systems Analysis (IIASA) conducted a preliminary study concerned with the role of informatics in the development of international data exchange activities. The purpose of this preliminary study was to determine the critical research issues associated with such exchange activities and the subset of these issues appropriate for further investigation by IIASA. The study, while concerned primarily with the role of informatics technology in exchange efforts, was not limited in perspective to technological issues.

The method used in conducting this study involved an expert panel convened for a one-day workshop in Toronto in August, 1977 to generate a preliminary list of research issues. Following the workshop a mailed questionnaire to the participants provided quantitative evaluation of the issues with respect to overall urgency and specific appropriateness for further IIASA research. In addition, the panel suggested five broad areas of research which were further evaluated for long-term research needs.

The major results of this quantitative evaluation indicated that eleven issues were of high urgency, Further screening provided eight of those that were appropriate for IIASA research (see Tables 2 and 3 of Chapter II). The final screening resulted in two issues which were further developed into brief research proposals (see Chapter III). These issues were:

- Identification of the major barriers to exchange programs (in terms of magnitude) of the barrier and also type of exchange activities affected

- Study of the organization structures most appropriate for international data exchange

programs and determination of application dependency of these structures.

In addition, a quantitative rating of five general areas of research was provided indicating the panel's view of long-term research needs in international data exchange.

The following ratings represent recommended relative allocation of research resources for each of the areas:

	%
User Analysis	25
User Training	12
Economic Factors	27
Privacy/Security	16
Competition/Conflict	20

Further details on this evaluation are available in Chapter II.

The complete list of research issues evaluated (see Appendix C) and particularly the urgent issues not rated highly appropriate for IIASA (including issues with a major focus on developing-country needs and issues dealing with development of services to meet specific user needs) should provide researchers and policy makers with guidelines for research within their own institutions.

TABLE OF CONTENTS

I. PROBLEM STATEMENT AND APPROACH

The aim of the 1977 research program on international data exchange activities was to identify the specific research questions in this broad area that could usefully be addressed by IIASA in the future. To accomplish this goal a group of individuals representing a wide cross section of academic, private, national, and international organizations was organized for a series of activities including a one-day workshop held in Toronto on 7 August 1977. The group provided extremely useful input both during the workshop and in follow-up correspondence.

The participants came from many organizations and countries and held varied perspectives of the international data exchange area. They are all involved in one or more of the facets of international data exchange described subsequently in this report. Their roles include that of researchers, managers, academicians, information specialists and members of international agencies.

Participants

Prof. H. Andersin	Helsinki University of Technology, Espoo, Finland
Prof. H. Borko	School of Library and Information Science, University of California, Los Angeles, California, U.S.A.
Prof. A. J. Dakin	Department of Urban and Regional Planning, University of Toronto, Toronto, Ontario, Canada
Mr. J.M. Dethoor,	Director, Office des Systèmes Informatiques et Documentaires, UNESCO, Paris, France
Mr. W. Dizard	U.S. Information Agency, Washington, D.C., U.S.A.
Prof. A.S. Douglas	Department of Statistics, London School of Economics and Political Science, London, England
Prof. J.H. van der Hende	Gebouw Analytische Scheikunde, Delft, The Netherlands

Mr. G. Jones	Managing Editor, Computer and Electronics Group, Guildford, Surrey, England
Mr. S.E. Jones	Canada Institute for Scientific and Technical Information, Research and Planning, National Research Council, Ottawa, Ontario, Canada
Mr. R. Kalman	UNESCO, Paris, France
Mr. S. Kassum	Manager, Computer Systems, International Development Research Centre, Ottawa, Ontario, Canada
Dr. H. Kopetz	VOEST-Alpine, Linz, Austria
Mr. R. Mendelssohn	Assistant Commissioner, Systems and Standards, Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C., U.S.A.
Prof. E.B. Parker	Institute for Communication Research, Stanford University, Stanford, California, U.S.A.
Mr. M. Robin	Institute de Recherche d'Informatique et d'Automatique, Le Chesnay, France
Dr. P. Robinson	Acting Chairman, Interdepartmental Committee, Computer/Communications Secretariat, Ottawa, Ontario, Canada
Dr. N. Rozsenich	Austrian Ministry of Science and Research, Vienna, Austria
Dr. K. Samuelson	Information Processing Informatics, Stockholm University and Royal Institute of Technology, Stockholm, Sweden
Mr. H. Sarbinowski	Institut für Datenfernverarbeitung und Gesellschaft für Mathematik und Datenverarbeitung, Darmstadt, Bundesrepublik Deutschland

In addition, the following IIASA staff members participated in the workshop: Dr. A. Butrimenko, Leader, Computer Science Group; Dr. D. Penniman, Research Scholar, Computer Science Group (and workshop moderator); and Mr. J. Page, Consultant, Computer Science Group.

Procedure

The overall approach of the IIASA study involved (1) development and distribution of preliminary material to the workshop attendees prior to the meeting, (2) generation of research issues and areas of concern at the workshop, and (3) follow-up ranking and evaluation of the issues and areas. The ranking procedure involved a single-round evaluation procedure. The overall approach has been used in many similar research programs. An excellent example involving the evaluated critical issue approach was conducted for the U.S. National Science Foundation in the area of scientific and technical information.* That study has provided many useful concepts for the IIASA preliminary task on international data exchange and served as a guide for presentation of the final results.

Prior to the IIASA workshop, a concept paper (see Appendix A) was distributed to all participants. This paper was intended to provide each participant with a common framework and understanding of the authors' initial view of the overall area of international data exchange and was based on work conducted by IIASA previously for UNESCO.** In addition, a selected bibliography (see Appendix B) was provided should the participants wish to pursue a particular area further before the meeting.

On 7 August 1977 the participants were gathered in Toronto for an all-day session in which they were asked to develop a list of researchable questions which were crucial to the expansion of international data exchange activities. These research questions at the broadest level were termed 'research issues' (which could involve multiple questions), and 'critical issues' were those which someone or some group considered to be crucial to the future suc-

---

*Freeman, James E. and Rubenstein, Albert H. "The Users and Uses of Scientific and Technical Information: Critical Research Needs", prepared for the Office of Science Information Service, National Science Foundation by the University of Denver Research Institute, Grant GN-40981, November 1974.

**Penniman, W.D. et al. "Study of the Use of Information Technology on Problems of Scientific and Technological Cooperation", prepared for the United Nations Educational, Scientific and Cultural Organization (UNESCO) by the Computer Science Group. International Institute for Applied Systems Analysis, April 1977.

cess of the area being studied. In addition to a list of critical issues, the workshop attendees proposed a broader set of categories or domains of interest for research with respect to international data exchange activities.

Following the workshop in Toronto the participants were asked to rate the edited list of issues according to urgency and also appropriateness for future IIASA research. The participants were also asked to allocate hypothetical research resources across the general set of research categories they had suggested at the workshop. Finally, they were asked to comment on the workshop itself. The issue and category evaluations were returned by 16 of the invited workshop participants. (See Appendix C for this material and a summary of the responses.)

The resulting rated and ranked issues and categories were further analyzed to select issues for future attention by IIASA and also issues which should be promoted as research topics for other institutions. The methods of data analysis are described in Appendix D. Finally, for the issues selected as both urgent and appropriate for IIASA, brief descriptions of research tasks were prepared as a starting point for future research programs.

Application of Results

Given the limited resources in terms of funds and staff, organizations concerned with international data exchange must select the most crucial areas for their direct attention. By using the techniques of an expert panel and a list of critical research issues generated and evaluated by that panel, the authors prepared this document which should be useful to researchers and especially to decision makers allocating funds for research related to informatics and exchange of data on an international level. It would also be useful to IIASA's own use for planning and developing future research activities in the informatics area.

Participant response regarding the methodology used (see Appendix C) indicated that the approach could be useful also for other planning activities at IIASA.

II. CRITICAL RESEARCH NEEDS

Research Areas: A Long-Term Perspective

Any attempt to provide input to decision makers on the priorities for research must take into account the specific pressures and perspective of those decision makers. When international issues are involved, the decision makers are often operating within different social and political frameworks. In the past, IIASA has defined its own perspective in terms of two types of research: global and universal.* Global problems cannot be resolved without joint action of several nations, while universal problems can be resolved by individual nations but the solutions may be shared by almost all nations. This distinction is important in considering the research needs in the area of international data exchange, and particularly in considering the appropriate research role for IIASA in this area in the future.

The expert panel convened in Toronto was asked to address research issues and areas initially irrespective of the IIASA perspective. Only after a wide spectrum of areas and issues were identified was the IIASA "filter" applied.

At the broadest level, the panel suggested five major categories or research areas which were appropriate to international data exchange. In the follow-up phase, the panel was asked to allocate across those five areas 100 points as if they were allocating research resources over an extended period of time (more than five years). This exercise represented their evaluation of the research priorities within a long-term perspective, and the results are presented in Table 1.

Clearly economic factors and user needs appear as the major long-term considerations with national/international conflict and competition, privacy and security factors, and user training playing lesser roles on the research activities.

---

*See address by R. E. Levien, director of IIASA, titled "Applying Systems Analysis in an International Setting", dated May, 1976.

Table 1. Results of Panel Allocation of Research Effort Across Five General Areas in International Data Exchange

AREA	Allocation out of Total of 100 Points*
User Identification and Needs Analysis	25
User Training for Data Use	12
Economic Factors (including who will own data; potential for manipulation of data for economic ends; and impacts on jobs, balance of payments, and information infrastructure, for example)	27
Privacy and Security Factors	16
Competition and Conflict Nationally and Internationally (including politics, culture, ideology, and economics, for example)	20

*Average values across 16 respondents, rounded.

Critical Research Issues: Near-Term Needs

The panel was also asked to rate the specific research issues they had established during the workshop process. The first rating was according to the urgency with which these issues should be addressed. This rating was to be independent of whether the issues were appropriate for IIASA and thus could be used by other organizations as well in planning their research programs.

The most urgent of these issues are presented in Table 2. The selection procedure is described in detail in Appendix D but was basically a process of screening according to average weights assigned by the panel using a five-point weighting scale. The levels of urgency are approximately of equal interval with the exception of the first level which might be labelled "much more urgent" in comparison to the remaining 10 issues. All issues in this table were weighted on the average at least above moderately urgent.

Research Issues for IIASA

Selecting from this set of issues those that were also considered most appropriate for IIASA research tasks and reordering the set by appropriateness provides the listing appearing in Table 3. Note that there is considerable difference in the ordering of the issues at the top end of both scales although the sets of issues are nearly identical. The single issue that is rated both quite high on the urgency scale and is very appropriate for IIASA to address is:

> "Identification of the major barriers to exchange programs (in terms of magnitude of the barrier and also type of exchange activities affected)".

The development of this issue into a more fully defined task description is presented in the next chapter along with a second task judged most appropriate for IIASA which was:

> "Study of organizational structures most appropriate for international data exchange programs and determination of application dependency of these structures".

Research Issues for Other Organizations

While most of the urgent research issues were also considered appropriate for IIASA by the panel, there were some that ranked high in urgency but did not rank commensurately high in appropriateness for IIASA. These issues are presented here as potential areas of research for other organizations which may be more appropriate for housing such studies. There were three such issues:

> "Study of how developing countries do now and/or can in the future take advantage of international data exchange".
>
> "Study of methods used by developing countries in acquiring and using data (with a focus on future techniques)".
>
> "Identification of the users of data in exchange programs and determination of how their needs can best be identified and translated into a useful service".

The first two issues are oriented toward developing-country needs which presumably is the reason why they ranked low in appropriateness for IIASA. User-needs analysis is, likewise, more appropriate for organizations intent on mounting a specific data exchange program rather than being conducted as a general needs analysis. A review of the urgency ratings for other issues in Appendix C may suggest other studies which interested organizations at the national, regional or international level my wish to undertake.

Table 2. Most Urgent Research Issues in International Data Exchange According to Expert Panel Ratings

First Priority*

Identification of the major barriers to exchange programs (in terms of magnitude of the barrier and also type of exchange activities affected).

Second Priority

Identification of the common national problems in data communications which relate to successful international data exchange activities.

Study of how developing countries do now and/or can in the future take advantage of international exchange activities.

Third Priority

Study of the reasons for success or failure of the organizations already working in the area of international data exchange and identification of the roots of the successes or failures.

Identification of what international communication and information services are now available and evaluation of their effectiveness.

Fourth Priority

Evaluation of need for data exchange programs to be imbedded within larger programs of technology transfer in order to survive.

Study of methods used by developing countries in acquiring and using data (with a focus on future techniques).

Identification of the users of data in exchange programs and determination of how their needs can best be identified and translated into a useful service.

*Priority levels indicate issues of equal priority. Issues receiving equal weights in the panel rating were placed at the same level. The selection procedure is described in detail in Appendix D.

Table 2 cont.

Fifth Priority

Determination of which data sets are now best organized and how they are most easily accessed.

Study of why past efforts at data exchange have failed or succeeded and development of techniques for identifying these factors (different from third priority issue in this respect).

Study of organizational structures most appropriate for international data exchange programs and determination of application dependency of these structures.

Table 3. Most Appropriate Issues for IIASA Research From the Set of Previously Selected Urgent Issues (Ordered by Appropriateness for IIASA Research)

First Level*

Study of organizational structures most appropriate for international data exchange programs and determination of application dependency of these structures.

Second Level

Identification of the major barriers to exchange programs (in terms of magnitude of the barrier and also type of exchange activities impacted).

Third Level

Determination of which data sets are now best organized and how they are most easily accessed.

Evaluation of need for data exchange programs to be imbedded within larger programs of technology transfer in order to survive.

Identification of the common national problems in data communications which relate to successful international data exchange activities.

Study of the reasons for success or failure of organizations already working in the area of international data exchange and identification of the roots of the success or failures.

Fourth Level

Study of why past efforts at data exchange have failed or succeeded and development of techniques for identifying these factors.

Identification of what international communication and information services are now available and evaluation of their effectiveness.

*These levels are of equal interval and represent sets of issues given equal weights on the appropriateness scale. The selection procedure is described in Appendix D.

Table 4. Comparison of Panel Weights for General Research Areas and Ratings for Specific Research Issues Classified by Area

RESEARCH AREA	Area Weight (out of 100 Points)	No. of Related* Issues	Average Issue Urgency Rating (5 is highest)	Average Issue Appropriateness for IIASA (5 is highest)
USER ANALYSIS (14,16,17,20,21,29)	25	6	3.4	3.4
USER TRAINING (1,7,25,27,29,31)	12	6	2.9	3.1
ECONOMIC FACTORS (2,5,6,11,12,24,26)	27	7	2.8	2.8
PRIVACY AND SECURITY (9)	16	1	--**	--**
COMPETITION AND CONFLICT (3,4,8,10,13,15,18,19,22,23,30)	20	11	3.3	3.4

*Issues assigned to each area are shown in parentheses in Research Area Column

**Insufficient data for evaluation

General Research Areas Versus Specific Research Issues

The general areas of research in international data exchange shown in Table 1 are related to the specific issues listed in Appendix C in that each issue can be assigned to one of the categories. Since there was no intent to develop the issues a priori as subcomponents of the general areas and since the relationship between areas and issues was not made explicit at the time that rating was done, the results of the rating efforts should provide a form of consistency check.

The number of issues per category is not uniform (e.g. Privacy and Security has only one directly related issue - # 9) and the relationship or lack thereof between area weights and issue ratings can be interpreted in several ways. In spite of this, it is useful to compare the outcome of the two parallel rating exercises by the same panel of judges.

A summary of this comparison is shown in Table 4. The User Analysis category represents an interesting area of evaluation because the most explicit statement of this area appears in Issue 20, which rated relatively low on the appropriateness scale for IIASA, as did Issues 16 and 17, yet the area in general rated ralatively higher. The two issues in this area seen as most appropriate for IIASA related to information collection and dissemination methods (Issues 14 and 29). Therefore, IIASA would seem to have a role in the area of methodology evaluation rather than actually doing user needs analysis. In the area of competition and conflict IIASA clearly has a significant role to play, with Issues 22 in particular requiring attention (i.e. barrier identification).

In the case of Privacy and Security, additional issues need to be evaluated. Also, although Economic Factors rated high in the long-term need for attention, the role of IIASA is clear only with respect to one issue (# 6 - related to organizational structures essential for survival). These results suggest that additional issues could be evaluated for future planning of IIASA's research directions as well as those of other organizations wishing to address critical issues in international data exchange. In addition, some of the issues suggested late in the process of issue rating

(see Appendix C) should be circulated for rating by the entire panel. While there is considerable room for more evaluation, the results of the ratings by the panel on both Areas and Issues provide a clear suggestion of research activities for both IIASA and other interested organizations.

III. SPECIFIC RESEARCH PROPOSALS FOR CRITICAL ISSUES OF HIGH URGENCY

For those issues found most urgent, but not necessarily appropriate for IIASA to undertake, we encourage the generation of research plans by other organizations. But for those issues most urgent and appropriate for IIASA, this section will present initial outlines of potential research activities. Two issues have been selected for evaluation. The first, barrier identification, ranked high on the IIASA appropriateness scale and was by far the highest-ranking issue in terms of urgency. The second, appropriate organizational structures for international data exchange, was highest in terms of IIASA appropriateness and also ranked high in terms of urgency.

Techniques for Barrier Evaluation

> "Identification of the major barriers to exchange programs (in terms of magnitude of the barrier and also type of exchange activities impacted)."

In order to transform this critical research issue into an operational plan for an IIASA research task, the problem of data collection must be addressed. Seldom are failures in any area well documented. Likewise, successes often are viewed in retrospect from a much different perspective than during the course of their evolution. An excellent example of data collection and analysis approach in a similar area can be found in a recent study by Sweezy and Hopper*. In that research program 112 innovations in information technology were evaluated to determine the major obstacles encountered. The innovations which were successful represented about 10% of the total sample. Data collection was done via

---

*Sweezy, Eldon E. and Hopper, Janice, H; "Obstacles to Innovation in the Scientific and Technical Information Services Industry", Final Report of the Institute of Public Administration to the National Science Foundation, October, 1975.

open-ended interviews in which 46 innovators and managers were asked to describe from their own experience past attempts at innovation. Rather then selecting the innovations *a priori* the interview subjects were selected who provided on the average over two innovation case descriptions each.

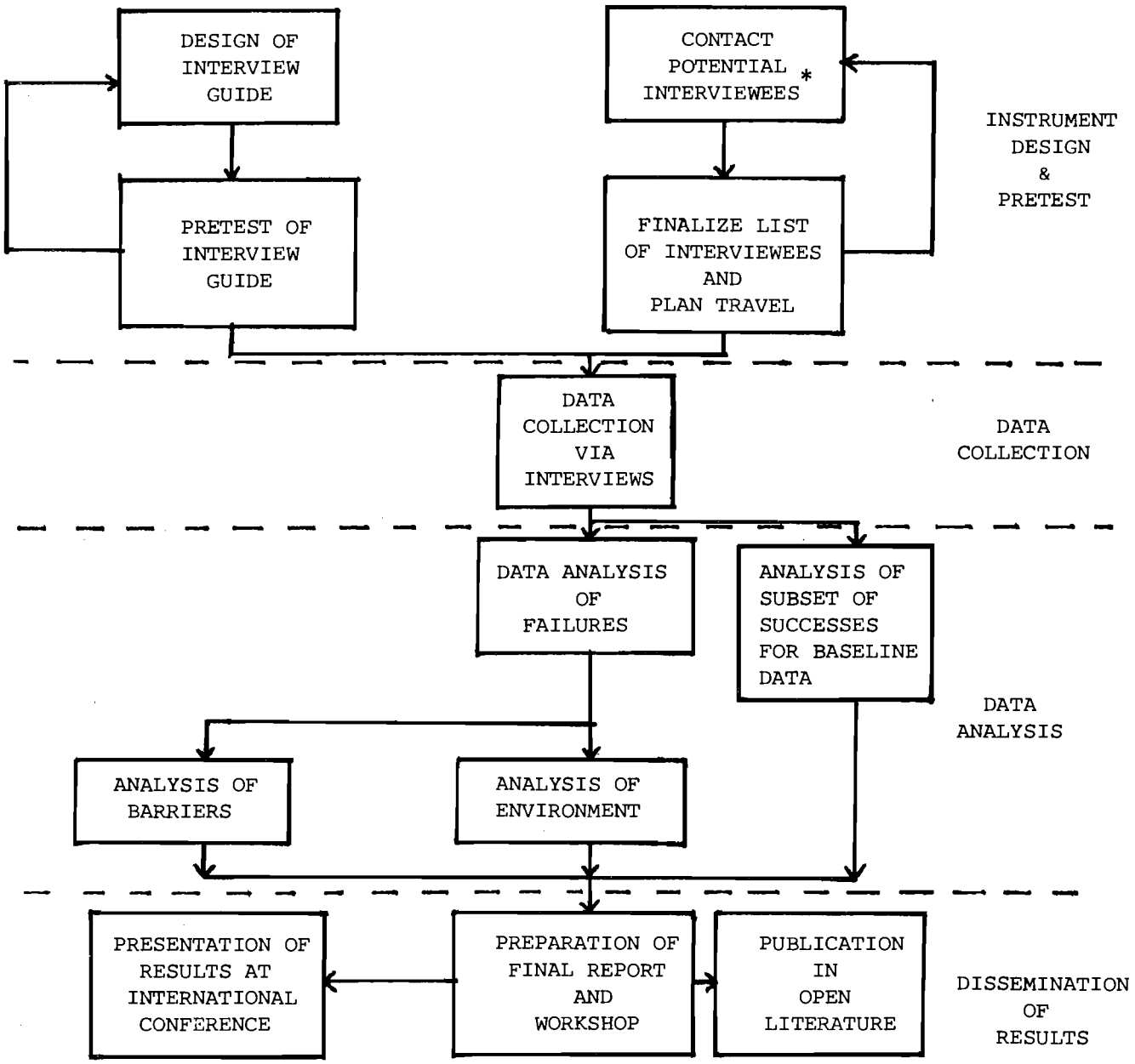
An identical approach is suggested for IIASA in that individuals representing a cross-section of NMO countries as well as representatives from international organizations such as UNESCO, UNIDO, and the IAEA be selected to constitute a sample of no less than 60 individuals including three from each member country and nine from international organizations. This represents a major interview process involving at least thirty person-days of effort for the interviews alone. The design of the interview guide should be quite straight-forward, but pretest on organizations located geographically close to IIASA is recommended. Figure 1 summarizes the approach described in these paragraphs.

Class of exchange program and types of barriers should be derived *ex post facto* from the collected case-study data and further analysis done upon those categories. In this case, magnitude of the barrier is reflected by the number of attempted exchange programs blocked as well as the pervasiveness of the barrier (i.e., appearance across several classes of exchange programs). An added dimension for evaluation should also be the socio-political environment of the exchange program initiations (i.e., international organization, western country, eastern country) in order to identify barriers most prevalent for each environment.

The individual cases used in this evaluation should not be included in the final report of this study and the anonymity of the source of specific cases should be protected.

While the emphasis of this study will be on data exchange efforts that have been blocked, a baseline set of operational exchange efforts should also be evaluated. They, too, should provide information on barriers encountered (and some insight into how they were overcome). In addition, this portion of the data collection should include interviews with

Figure 1: Approach to the Study of Barriers of International Data Exchange Programs



* Users and operators of exchange programs and international activities where such programs are initiated.

users of these exchange activities as well as operators of them to evaluate the difference in perception with respect to the barriers encountered.

The study should require approximately eight calendar months to accomplish and should be funded to support the equivalent of one-person year plus travel involving at least one trip to the United States and Japan. The results of the study should be published in the open literature as well as through formal IIASA publication.

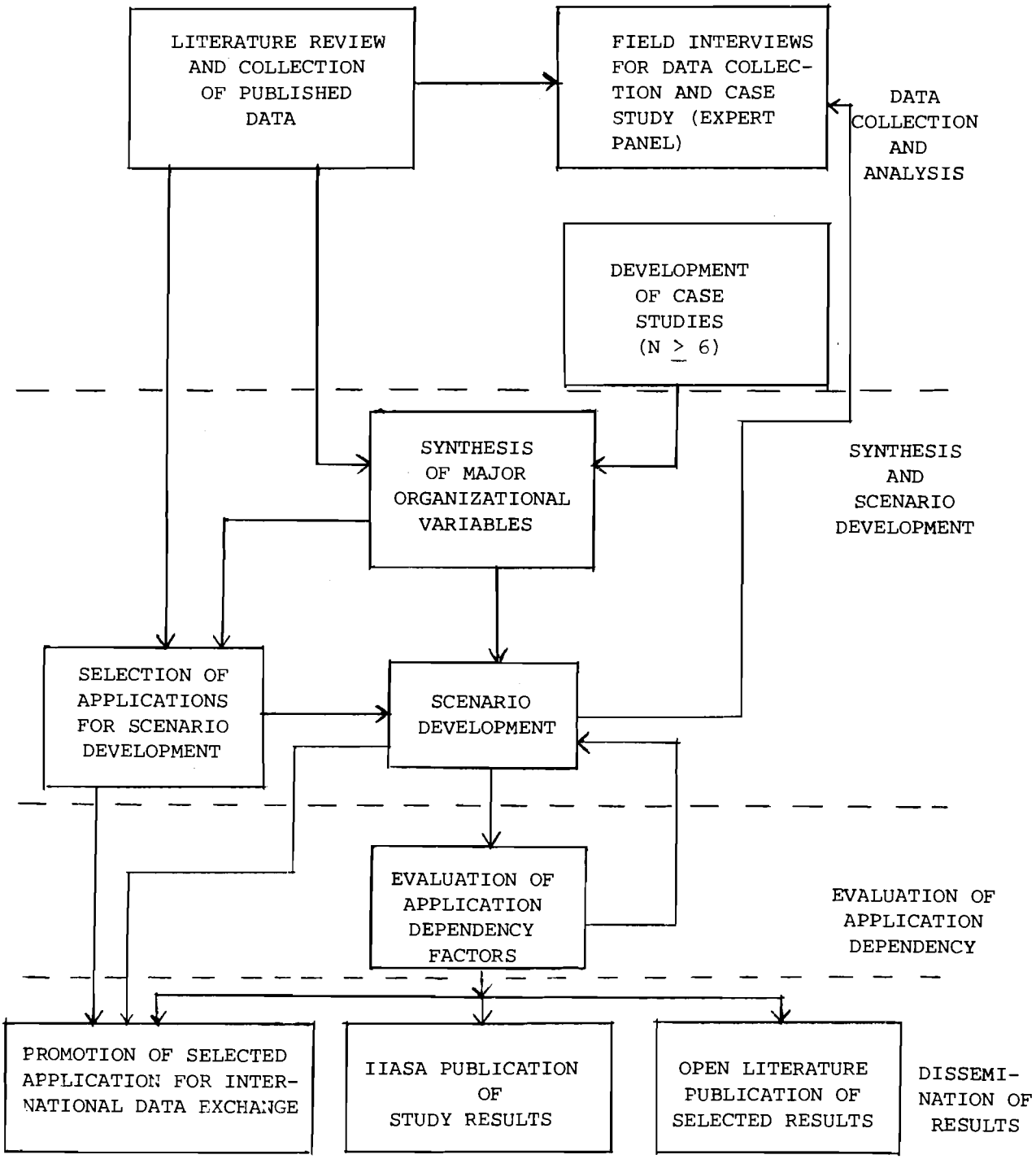
Study of Organizational Structures

> "Study of organizational structures most appropriate for international data exchange programs and determination of application dependency of these structures."

The evaluation of organizational structures should be undertaken from a broad viewpoint to provide an overall conceptual approach which can be useful to the implementers of exchange programs. The general design for research in this area should include an evaluation of available literature in organizational research and design and a series of case studies of successful exchange activities. (There is a clear opportunity for joint data collection in this and the previously described study). These two major sources of information should then lead to scenario development for hypothetical international data exchange programs. These scenarios should be oriented toward illustrating what, if any, influence the application has on the organizational structure. The sources of the case studies will also serve as an expert panel for review of the preliminary scenarios.

The general outline of this approach is illustrated in Figure 2. This diagram also illustrates the cyclic nature of the approach in that several rounds may be required to settle on satisfactory scenarios. The iterative nature of this approach lends itself well to interactive conferencing via computer (or face-to-face provided the participants can

Figure 2. Approach to the Study of Organizational Structures for International Data Exchange Programs



meet several times during the course of the study).

This task will require an estimated 18 calendar months to complete (exclusive of publication of the results) and should be funded to support an equivalent of two-person years plus travel within Europe. In addition, three workshops of two days each with no more than twelve participants should be planned. In the event that a data communication network is available at least two of these workshops could be replaced by computer conferences. The results of the study will be disseminated in three ways: the informal promotion of specific international data exchange applications via IIASA spokesmen, the preparation of an IIASA publication presenting the complete research program, and publication in the open literature of selected results.

IV. CONCLUDING REMARKS

This project was initiated in order to identify research areas within the broad arena of international data exchange which should be addressed in the near and long term. The procedure involving an expert panel provided results which may not agree with the opinions of other experts (and may not even be agreeable to the individual members of our panel). On the other hand, the results do represent a composite view of representatives from several different disciplines and national/international interests.

The findings provide some clear directions for future work. Two potential studies for IIASA have been outlined in the previous chapter. Other projects will undoubtedly be established as a result of this evaluation. It is important to note that the list of critical issues used in this study is by no means exhaustive. As illustrated in Table 4 of Chapter II, more issues need to be explored in the area of security/privacy and issues of greater urgency may well exist with respect to economic factors.

In addition, the study tended to focus on near term needs in that over 60% of the issues had an average rating of moderately urgent or above. While it is difficult to identify specific long-term needs, the rating of general areas as shown in Table 4 suggests that these areas should also have additional issues of a long-term nature.

A future effort should include a rating of issues along three dimensions: urgency, appropriateness, and long-term importance. This would provide a clearer indication of gaps in coverage of the list of issues.

Finally, this study should be viewed as a starting point for researchers, system implementers, and policy makers concerned with international data exchange. The issues not considered appropriate for IIASA research contain many ripe ideas for studies on a national or international level. For system implementers, this can serve as an initial check list for them

when considering the design of a new data system with applications at the international level. And finally, for the policy makers who have an opportunity to establish, fund, and promote such systems (or block and/or impede them) this evaluated list of issues provides a series of challenges. They can use this list to their own ends. We hope they will choose to promote international data exchange and use the list constructively.

APPENDIX A

POSITION PAPER PREPARED BY IIASA PRIOR TO TORONTO WORKSHOP

POSITION PAPER
ON A STRUCTURED APPROACH FOR THE ANALYSIS OF PROBLEMS AND PROSPECTS IN INTERNATIONAL DATA EXCHANGE

IIASA Workshop on International Data Exchange
August 7, 1977
Royal York Hotel, Toronto

Prepared by D. Penniman, A. Butrimenko, and J. Page
Computer Science Group
International Institute for Applied Systems Analysis
Laxenburg, Austria

Table of Contents

A Structured Approach for the Analysis of Problems and Prospects in International Data Exchange

Introduction

At a time when individual countries are still trying to clarify their policies on emerging national data communication and computer networks, there is a growing pressure to establish similar networks of an international scope. The prospects and uncertainties associated with these international networks are magnified by the dynamic nature of national networking policies as well as the unique problems of international ventures. The goal of the IIASA exploratory study of international data exchange is to clarify the critical issues associated with international networking as a mechanism to promote data exchange between nations. This date exchange would be focused on major global and international problems such as health care, food and agricultural resources and environmental monitoring. A more complete list of such problems appears later in this paper.

In order to evaluate the potential for networking as a mechanism for promoting international data exchange in areas of contemporary concern a systematic approach is required. This paper suggests an approach and identifies some of the issues involved. It is intended as a starting point only, and the purpose of the IIASA Toronto Workshop is to clarify the critical issues and appropriate structure for issue assessment. The

phrase "critical issues" in this paper refers to problems which at this stage are unresolved and could be decisive in establishing successful data exchange activities. In many cases these critical issues can be resolved through systematic research or analysis and of that subset there should be appropriate issues for IIASA to address. It is for this purpose that IIASA is conducting the exploratory study and workshop on international data exchange.

Much of this paper is taken from a report generated for UNESCO by IIASA titled "Study of the Use of Informatics Technology on Problems of Scientific and Technological Cooperation." *

Application Areas for International Data Exchange

The application of informatics technology in the international arena offers great promise. While individual applications may not provide adequate justification for a major research effort, a combined set of international cooperative activities could form the nucleus for an international data exchange effort with a per unit cost that could be reasonable for many countries. The application areas itemized here should be viewed only as a partial selection. Additional areas need to be identified and evaluated in order to compound the cost reductions and increase the motivation for cooperative activities. Clearly, for some applications (e.g. airline reservations, most financial transactions) private activities may prove satisfactory, but for most areas the need for a combined effort is a necessity.

Organizations already involved in selected aspects of international data exchange are identified in Table 1 and brief descriptions of potential application areas are presented in the following paragraphs.

---

* Report prepared in 1977 for the United Nations Educational Scientific and Cultural Organization by the Computer Science Group with the participation of the Management and Technology Area, International Institute for Applied Systems Analysis.

o World Health Care System

Present efforts at the organization of data on communicable diseases are inadequate. The knowledge at an international level of which national centers specialize in which diseases is limited. Data on rare diseases is sparse in any one country but when combined on an international level could be adequate for analysis. Standardized terminology for diseases exists, but is still needed for pharmacology. An international system for exchanging data on drug side-effects is needed (possibly based on the Hungarian system). (WHO, UNEP).

o Food and Agriculture

Adequate food supply throughout the world is now becoming a major problem. While some countries have achieved highly efficient production others still rely on outdated methodology. The need for improved technology and mechanisms for trade and market forecasting is evident. Information on such aspects as genetic lines, agricultural techniques, and improved equipment could help significantly in planning better strategies for food production and supply. Information on the ocean as a resource for food is inadequate. A permanent and well-organized mechanism for data exchange on fishing and biological resources of oceans is needed. (FAO, CED, IAALD).

o Scientific and Technological Information

Huge financial and intellectual resources are devoted to development and scientific research, and estimates show that the resources are doubled every ten years. Yet, the returns on these investments have a tendency to decrease. In addition to the developing countries' need to speed up economic progress, they must find ways to maintain the pace of technological progress. Technology transfer is viewed as the solution and a number of commercial firms are

addressing individual aspects of this via computer information services of bibliographies, patents, experts available for consultation, and technologies for sale. In addition, there are organizations concerned with the international exchange of numerical data and patent information. (UNDP, UNESCO, UNIDO, EURONET, ICSU, INPADOC, WFEO, IAEA).

o Environmental Monitoring

The existing worldwide weather forecasting system needs to be extended to broader applications such as crop forecasts and land use patterns. Warning systems for natural disasters need to be strengthened and man-made disasters such as pollution need improved monitor systems. Coordination of local, regional and global environmental monitoring systems is needed for increased compatibility. Referral systems to existing information services are just one needed activity in this area. (UNEP, IMO).

o Education

The rapid progress of technology leads to a new pattern of time constraints in the educational systems of today. At a time when knowledge and qualifications are becoming one of the most significant resources in the world, the educational systems are producing graduates whose knowledge will be obsolete in a very short time. The students of today must be prepared to continually update their education and possibly even change their professions. The need for improved systems of education may be partly satisfied by computer-aided instruction mechanisms. If natural language interface mechanisms can be perfected these, too, will aid in creating a dynamic mechanism for education. There is a need currently for the exchange of information and data on computer-aided instruction methods and software as well as improved methods for natural language interfaces. (UNESCO, DD, IBI).

o Social Science

There is a current pressure to expand world information activities in science and technology to include the social sciences. Activities such as UNISIST are now being viewed for possible expansion into these areas. This is an area of great potential when the overall problems of technology transfer are considered, as many of them are not technical in nature. The sharing of knowledge in the social/behavioral area would help greatly to promote more effective technology transfer. (UNESCO, ILO).

o Transportation

While certain areas of the transportation arena such as airline reservations are already handled on an international level, there is need for exchange of research and statistical data on all transportation modes. Of particular interest is economic data on transportation. (OECD, IUR, ECMT).

o Industrial Development

Sharing of experience in industrial development can lead to more efficient efforts in this area and less repetition of past failures. Particular emphasis is needed on past experiences in developing countries and the open discussions of success and failures in industrial development. (UNIDO, UNESCO).

o Financial Information

Although there are many organizations both public and private which maintain world financial information, there is vast discrepancy between the financial systems and capabilities of various countries. With more rapid and efficient exchange of data on financial resources it might be possible to consider world barter systems to counteract barriers where monetary flow is inhibited. (IMF, WB).

Table 1: Partial List of Organizations Concerned with International Data Exchange

(CEC)	Commission of European Communities
(DD)	Data for Development
(ECMT)	European Conference of Ministers of Transport
(EURONET)	European Network for Information and Documentation
(FAO)	Food and Agriculture Organization
(IAALD)	International Association of Agricultural Librarians and Documentalists
(IAEA)	International Atomic Energy Agency
(IBI)	Intergovernmental Bureau for Informatics
(ICSU)	International Council of Scientific Unions
(ILO)	International Labour Office
(IMF)	International Monetary Fund
(IMO)	International Meteorological Organization
(INPADOC)	International Patent Documentation Center
(IUR)	International Union of Railways
(OECD)	Organization for Economic Cooperation and Development
(UNDP)	United Nations Development Program
(UNEP)	United Nations Environment Program
(UNESCO)	United Nations Educational, Scientific and Cultural Development
(UNIDO)	United Nations Industrial Development Organization
(WB)	World Bank
(WFEO)	World Federation of Engineering Organizations
(WHO)	World Health Organization

Informatics Technology for International Data Exchange

The major development in informatics technology which holds promise for international data exchange is the computer-communications revolution leading to a proliferation of networking activities. Emerging networks provide a new vehicle to promote and implement the exchange of data in the area just described. For convenience of analysis, it is suggested that the following classification of networks be used.

- o International Time Sharing Networks

This network class includes General Electric's MARK III, Control Data's CYBERNET, and TYMSHARE's TYMNET where its host computers are used by the customer. Such networks offer basically a computing service and provide a data communications service for the users of the vendor's computers.

- o Value-Added Communication Networks

In this class are TELENET (a packet-switched network) and TYMNET (a circuit-switched network) where the customer uses only the data communication services offered by TYMSHARE. Value-added communication networks are pricing their communication services in such a way that they are distance-independent in many cases. In addition, they offer such services as store-and-forward message switching, terminal interfacing, error detection and correction, and host computer interfacing. A value-added network is a communication facility and does not provide end services such as computation or information.

- o Networks for Scientific Computing

These networks differ from commercial time-sharing networks in the greater complexity and variety of design problems they pose. In many cases they have been established as experiements in computer networking with less emphasis on regular service and more emphasis on experimentation. The

best known example of such a network is ARPANET developed in the United States via Department of Defense funding. Such networks provide insights into the solution of political and management problems associated with cooperative computing facilities as they generally link several diverse organizations.

o Information Retrieval Networks

These networks provide distribution of scientific and technical information (STI) and are already firmly based as a form of international collaboration with a clearly established user base. Examples include ESANET (European Space Agency), SCANNET (Scandinavian countries) and the planned EURONET (European Economic Community). These examples all involve the linkage of several host sites where data bases reside. In the United States, Lockheed and SDC as well as others have developed STI services which use single host computers (with many data bases) and value-added communication networks to create another form of information retrieval network.

o Human Communication Networks

In recent years the use of computers in conjunction with communication networks to provide human-to-human communication has grown rapidly. Over 25 systems currently exist which provide some form of human communication service from simple mailboxes to complex conferencing capabilities. These systems are often started to satisfy internal organizational requirements and then become commercial offerings (as in the case of Mailbox by Scientific Time Sharing Corporation) or have moved from the research stage to the commercial stage (as in the case of Infomedia's TOPICS and NOTEPAD). The one major function that all such networks share is the linkage of people to people rather than people to computers.

Matching Application Areas and Technologies

The previous two sections have (1) reviewed some areas where international data exchange could be most beneficial

and (2) identified different forms of networking which could be used to promote international data exchange. Bringing these two aspects together to create functional programs in international data exchange will require systematic evaluation and planning by the many concerned organizations.

While each application area could utilize many of the available network technologies, some are more appropriate for the current stage of development. As an example, in health care systems there is a need to develop standard drug terminology and side-effect reporting systems. Therefore a human communication or conferencing network would be of immediate benefit in establishing a link between experts in different countries to develop such standards. Also, there is a need for a coordinated data base of world disease information. Therefore an information retrieval network is also immediately relevant.

In food and agriculture, sharing of information on modern farming techniques calls for an information retrieval network. The need for improved techniques for trade and market forecasting calls for the use of a scientific computing network where models developed at various host sites could be tested and used by several countries.

Table 2 represents the preliminary analysis of all areas of application described in the first section of the paper. The "X" marks indicate areas where the clearest potential exists for immediate application of networking to international data exchange problems. This analysis provides a first cut at establishing priorities for application, but clearly there are many levels of priority represented and the selection of the primary areas to address is not a simple matter of counting "X's".

Special note must be made of international data exchange activities involving developing countries. These programs will require several components, perhaps the least of which is a sophisticated network. Too often the information system

Table 2: Matrix of Problem Areas for International Cooperation and Relevant Networking Technologies

APPLICATION	NETWORK TYPE: International Time-Sharing	Value-Added (data-communication)	Scientific Computing	Information Retrieval	Human Communication
o Health				X	X
o Food/Agriculture			X	X	
o Scientific/Technological Information Exchange	X	X	X	X	X
o Environmental Monitoring		X	X		
o Education	X		X	X	
o Social Science				X	
o Transportation		X		X	
o Industrial Development				X	X
o Finance		X			X

aspects of technology transfer are emphasized at the expense of other components necessary to the success of data exchange with developing countries. Components of major importance for such countries include: (1) decoding mechanisms in the form of consultants and local experts who can apply the data in a local context, (2) involvement of national policy-making bodies to assume a coordinated activity with a minimum of red-tape barriers, (3) an entrepreneurial spirit for the technological innovations being provided via information exchange and (4) a national infrastructure necessary for the support services/ information activities.

There is currently no single source of information for establishing international data exchange activities where developing countries are involved and for that matter there are no well-documented guidelines for establishing international data exchange activities in general.

Barriers to the Application of Networking to International Data Exchange

A number of areas which pose potential barriers to international data exchange have been identified from studies of related literature. These are listed here and their impact on potential application areas for international data exchange is also evaluated.

- o Regulatory Problems

This area focuses on the concerns of international regulatory bodies such as the International Telegraph and Telephone Consultation Committee (CCITT). At the very least, agreements are a lengthy process involving compromises often not in the best interests of the users.

- o Interconnection Problems

The user would ideally prefer access to private and public networks via one connection. For the case of message switching, the use of public communication networks is restricted while access to time-shared services is allowed.

o Technical Problems

As an example of this class of problem, the disparity in technical development between different telecommunications systems in various countries prevents international data communications from being conducted with the same ease as current global voice-grade telephone connections.

o Legal and Political Problems: General

Some form of enforcement legislation is necessary to inhibit misuse of international data connections. Monitoring of all data flow is not possible (or desirable) yet national authorities need some means of regulating flow into and out of their country.

o Privacy of Personal Data

The control of access to personal data by third parties for additional purposes (other than that for which the data were provided) has been a major privacy issue. Additional areas of concern include right of governments to monitor data flow (previously mentioned) and the creation of "data havens" to avoid restrictive privacy legislation.

o Privacy and Security: Broader Aspects

In addition to the conflict between personal privacy and a government's right to enforce legal use of data channels, there exists broader concerns such as misuse of data at a national level for manipulating trading positions or jeopardizing national security.

o Intellectual Property Rights

Current copyright restrictions are inadequate for the present shift from printed publication to electronic dissemination. This problem is already apparent in scientific and technical information dissemination, but is not confined to this area.

o Economic Problems

The complexity and variation of pricing practices for international data circuits is a major problem. The introduction of satellite communications may provide a better understanding of this area as prices charged to the carriers for satellite links are on public record and can be analyzed in comparison to prices charged to the user.

An analysis of these barriers with respect to each of the previously described application areas for international data exchange is needed. As an example, the health area was identified as requiring exchange of data on specific diseases of an epidemic or rare form. In addition, standardized reporting techniques were considered critical in this instance. Each country participating in this exchange would face the political issue of disclosing possibly image-damaging data regarding disease situations at a national level. At a personal level, health statistics would have to be screened to protect privacy. Finally, because much of the useful data would come from developing countries and remote areas there would be an economic limitation on the data collection network.

An initial evaluation of each barrier/application intersection is presented in Table 3 where the "X's" represent major areas of concern.

Conclusions

The framework presented in this paper involved three sets of variables: (1) application areas for international data exchange, (2) network types to be used in the exchange process, and (3) barriers to international data flow. A preliminary analysis of the interactions between these variables has been presented to initiate discussion of major issues which need to be addressed in a systematic manner.

Table 3: Application/Problem Interaction Matrix

APPLICATION	PROBLEMS INHIBITING INTERNATIONAL COOPERATION IN DATA EXCHANGE							
	Regulatory-General	Interconnection	Technical	Legal/Political	Privacy/Personal	Privacy/Security-General	Intellectual Property Rights	Economic
Health		X		X	X			X
Food/Agriculture		X	X					X
Scientific/Technological Information Exchange	X	X	X	X				X
Environmental Monitoring		X	X					X
Education		X	X					X
Social Science		X	X				X	
Transportation	X	X				X		
Industrial Development		X				X	X	
Finance	X	X			X		X	

Workshop participants should view this document as a starting point for discussion and should feel free to come to the workshop with additions or changes to the framework, keeping in mind that the end goal is a structured list of international data exchange issues requiring research. In addition the appropriate role for IIASA in resolving these issues is of major concern.

Areas already identified by IIASA as appropriate for additional effort include:

- o establishment of a continuing working group on international data exchange.
- o preparation of case studies of existing international data exchange activities
- o development of scenarios for implementing data exchange in selected new areas
- o development of a procedural guide for initiating international data exchange efforts

APPENDIX B

BIBLIOGRAPHY OF SELECTED MATERIAL FOR THE APPLICATION OF INFORMATICS TO INTERNATIONAL DATA EXCHANGE

BIBLIOGRAPHY
OF SELECTED MATERIAL FOR THE APPLICATION
OF INFORMATICS TO INTERNATIONAL DATA EXCHANGE

Prepared

April 1977

Computer Science Group
International Institute for Applied Systems Analysis
Laxenburg, Austria

Table of Contents

Bibliography of Selected Material for the Application of Informatics to International Data Exchange

• BIBLIOGRAPHIES AND SERIALS

Annual Review of Information Science and Technology, Volumes 1-12 (Washington D.C.: American Society for Information Science, 1966 - present)

Cornell University, Science and Technology for International Development: A Selected List of Information Sources in the United States and Bibliography of Selected Materials, 2nd ed. (Ithaca, NY: Cornell Univ., 1975)

Fackelman, Mary P., and Kimberly A. Krekel, International Telecommunications Bibliography, OT-SP-76-7 (Washington, D.C.: Analytical Support Division, Office of Telecommunications, 1976), NTIS: pp - 251958

Information Hotline, formerly Information News & Sources, (New York: Science Associates, Inc., 1974 - present)

Technological Information Systems and Services for Innovation: A Selective Bibliography (Geneva: UN Library, 1973)

• AREAS FOR INTERNATIONAL DATA EXCHANGE

Agribusiness Council, Agricultural Initiative in the Third World: A Report on the Conference, Science and Agribusiness in the Seventies (Lexington, Mass.: Heath, 1975)

Ahmed, Manzoor, and Philip H. Coombs, eds., Education for Rural Development: Case Studies for Planners (NY: Praeger, 1975)

Balassa, Bela, and Ardy Stoutjesdijk, "Economic Integration among Developing Countries", Journal of Common Market Studies, (Sept. 1975), pp. 37+

Basche, James R., Jr., and Michael G. Duerr, International Transfer of Technology: A Worldwide Survey of Chief Executives (NY: Conference Board, 1975)

Bendavid-Val, Avrom, and Peter P. Waller, eds., Action-Oriented Approaches to Regional Development Planning (NY: Praeger, 1975)

Boodhoo, M. J., "Dilemma in Development Strategy: The Case of the Industrial Development Agency in Third World Countries", African Review, 1975, No.2, pp. 167-86

Economic Commission for Africa, Nature of the Information Problems in African Industrialization, ID/WG.119/8 (Vienna: UNIDO, 1972)

FAO, Food and Nutrition Strategies in National Development: Ninth Report of the Joint FAO/WHO Expert Committee on Nutrition Rome, 11 - 20 December 1974, (FAO, 1976)

Gartner, J., and C.S. Naiman, "Overcoming Barriers to Technology Transfer", Res. Manag., 19(2): 22 - 28 (1976)

Gibson, Ted A., "Technology Transfer and Economic Progress", Business Economics (May 1976) pp. 23-30

Goulet, Dennis, "The Suppliers and Purchasers of Technology: A Conflict of Interests", International Development Review, 1976, No.3, pp. 14-20

Herz, Barbara K., "A New Approach: Integrating Health and Family Planning Services", War on Hunger (May 1976), pp. 13-15

Howe, James W., The US and World Development: Agenda for Action (NY: Praeger, 1975)

IBRD, The Assault on World Poverty: Problems of Rural Development Education and Health (Baltimore, Md.: John Hopkins University Press, 1975)

"Industrialization and Development: Progress and Problems in Developing Countries", Journal of Development Planning, 1975, No.8, pp. 1-60

Jones, Gavin, Population Growth and Educational Planning in Developing Countries (NY: Irvington, 1975)

Kissinger, Henry A., "Global Consensus and Economic Development", Department of State Bulletin (Sept. 22, 1975), pp. 425-41

Körner, Heiko, "Need for Modernizing Financial Institutions", Intereconomics, (Nov. 1975), pp. 338-40

Lambertini, Adrian, "Energy Problems of the Non-OPEC Developing Countries", Finance and Development (Sept. 1976), pp. 24-8

Lloyd, Bruce, "The Role of Capital Markets in Developing Countries", Moorgate & Wall Street (London) (Spring 1976), pp. 45-68

Luxton, P., "Environmental Issues and the Developing Economies", Intereconomics (Oct. 1976), pp. 279-82

Maynard, Geoffrey, and Graham Bird, "International Monetary Issues and the Developing Countries: A Survey", World Development (Sept. 1975), pp. 609-640

Moravcsik, Michael J., and J.M. Ziman, "Paradisia and Dominitia: Science and the Developing World", Foreign Affairs (July 1975), pp. 699-724

Mountjoy, Alan B., Industrialization and Developing Countries, 4th rev. ed. (London: Hutchinson, 1975).

Patel, I.G., "What the Developing Countries Really Want: Food and Shelter Are by No Means the Only Aspirations", Atlas, (Feb. 1976), pp. 22-3

Pearson, Charles, Implications for the Trade and Investment of Developing Countries of United States Environmental Control (NY: UN Conference on Trade and Development, 1976)

Philippart, Andre, "Science and Modern Politics", Government and Opposition (Autumn 1975), pp. 473-91

Salgado, Germanico, "Economic Integration of Developing Countries and the Role of Joint Industrial Planning", Journal of Development Planning, 1975, No.8, pp.167-93

Sen, Amartya, "Employment, Institutions and Technology: Some Policy Issues", International Labour Review (July 1975), pp. 45-73

Simmons, Ruth, et al., "Organizing for Government Intervention in Family Planning", World Politics (July 1975), pp. 569-96

Swerdlow, Irving, The Public Administration of Economic Development (NY: Praeger, 1975)

Technology Transfer; Successes and Failures, G.K. Manning, ed. (San Francisco Press, Inc., 1974)

Timmer, C., et al., The Choice of Technology in Developing Countries (Cambridge, Mass.: Harvard University, Center for International Affairs, 1975)

United Nations, Dept. of Econ. and Social Affairs, Public Administration and Finance for Development: Review of Progress and Problems in the Context of the International Development Strategy for the Second United Nations Development Decade (NY: UN, 1975)

United Nations, Trade and Development Board, Debt Problems of Developing Countries: Report of the Ad Hoc Group of Governmental Experts on its Third Session, Geneva, February 25 - March 7, 1975 (NY: UN, 1975)

- INFORMATICS TECHNOLOGIES

Baum, H., "World Meetings Information Center", Information: News and Sources, (Nov. 1975), pp. 285-7

Blanc, Robert P. and Cotton, Ira W., (eds.), Computer Networking (NY: IEEE, 1976)

Brockhoff, Klaus, et al. "DELPHI.F4: Ein Dialogsystem zur Unterstützung von Prognosen unter Benutzung einer Datenbank", Angwandte Informatik, Vol. 18, No.10 (1976), pp. 429-437

Burchinal, Lee G., "Networking Projected from US Experience", ASIS Bulletin, Vol. 2, No.4 (Nov. 1975), pp. 11+

Burchinal, Lee G., "Recent Trends in Communication of Scientific and Technical Information", ASIS Bulletin (Sept. 1975), p.9

Burchinal, L.G., "Telecommunications: Revolutionizing Science Communications", ASIS Bulletin (June 1975), p.9

"Computerized Conferencing: A New Medium", Mosaic (Jan/Feb. 1976)

Davey, J.S., and E.S. Smith, "The Overseas Services of the British Library Lending Division", UNESCO Bulleting for Libraries, Vol. 29, No.5 (1975), pp. 259-267

Edelson, Burton I., "Satellite Communications for Information Networking", in Wilson, World of Info., pp. 175-197

"The Future of Computer Conferencing", The Futurist (Aug. 1975), pp. 182-195

Hiltz, Starr Roxanne, and Murray Turoff, Potential Impacts of Computer Conferencing upon Managerial and Organizational Styles, (Newark, N.J.: Computerized Conferencing and Communications Center, New Jersey Institute of Technology, 1976)

Hotline International, Computer Conferencing at International Conference (NY: Hotline International, 1976)

Interactive Consulting Program (ICP), mimeograph, (Los Angeles, Calif.: University of California at Los Angeles, Health Sciences Facility, n.d.)

Johansen, Robert, et al., The Camelia Report: A Study of Technical Alternatives and Social Choices in Teleconferencing R-37 (Menlo Park, Calif.: Institute for the Future, 1977)

Kaerger, D., "Das Dialog-System DIALOG.F.4 für Delphi-gruppen", presented at Seminar für Betriebswitschaftslehre der Universität Kiel, No.20 (Nov. 1974)

Kupperman, Robert H., et al., "Crisis Management: Some Opportunities", Science, (Feb. 7, 1975), pp. 404-410

Lipinski, Andrew, et al., "Computer-Assisted Expert Interrogation: A Report on Current Methods Development", Technological Forecasting and Social Change, Vol.5 (1973), pp. 3-18

Martin, Shirley, et al., Practical Experience in Computer-Based Message Systems, (Alexandria, Va.: US Army Material Development and Readiness Command, 1976)

Millard, G.C., Computer Mediated Interaction (CMI) User Guide (Ottawa, Canada: Bell Northern Research, 1975)

Parnes, Robert, et al., User's Guide to CONFER II: An Introduction to Computer-Based Conferencing (Ann Arbor, Mich.: Center for Research on Learning and Teaching, 1976)

PLANET User Guide (Menlo Park, Calif.: Institute for the Future, 1976)

Pool, Ithiel de Sola, "International Communications Services", Bulletin of the American Society for Information Science, Vol.2, No.1 (1975)

Samuelson, K., "Global Networks for Informatics, Communications and Computers", Proceedings 1973 Nat. Computer Conference, p. 215

Samuelson, Kjell, "Implementation of International Information Systems", in Wilson, World of Info., pp. 229-241

"Science Information Services", FID News Bulletin (July 1975), p. 84

System Development Corporation, A World of Information at Your Fingertips (Santa Monica, Calif.: SDC, 1973)

Thomas, Uwe, Computerized Data Banks in Public Administrations: Trends and Policy Issues (Paris: OECD, 1971)

Turoff, Murray, "Potential Applications of Computer Conferencing in Developing Countries", Proceedings of the Special Rome Conference on Futures Research, Instituto Ricerche, Applicate Documentazione e Studi, Rome, Italy (1974)

Umpleby, Stuart, "Structuring Information for a Computer-Based Communications Medium", AFIPS Proceedings, Fall Joint Computer Conference, Vol.39 (1971)

Union of International Associations, Annual International Congress Calendar (Brussels: UIA, 1976)

Vallee, Jacques, et al., Group Communication through Computers: Volume 3, Pragmatics and Dynamics, Report R-35 (Menlo Park, Calif.: Institute for the Future, 1975)

Vezza, A. and M.S. Broos, An Electronic Message System: Where Does it Fit (Cambridge, Mass.: Laboratory for Computer Science, MIT, 1976)

Werdel, J.A., and S. Adams, "US Participation in World Information Activities", ASIS Bulletin (March 1976), pp. 44-8

World Guide to Technical Information and Documentation Services, Second ed. (Paris: UNESCO, 1975)

• MATCHING PROBLEM AREAS AND TECHNOLOGIES (General)

Adams, Scott, and Judith A. Werdel, "Cooperation in Information Activities through International Organizations", in Carlos A. Cuadra and Ann W. Luke, eds., Annual Review of Information Science and Technology, Vol.10 (Washington D.C.: American Society for Information Science, 1975), pp/ 303-356

Ah Mai, Karen L., Organizational Alternatives for a Pacific Educational Computer-Communications Network, Report UH-AS-TR-CH-74-27 (Honolulu: University of Hawaii, ALOHA System, 1974)

Ah Mai, Karen L., Pacific Educational Computer Network Study: Results of the Second Planning and Review Meeting, Report HU-AS-CN-74-33 (Honolulu: University of Hawaii, ALOHA System, 1974)

The Application of Computer Technology for Development, No.E73 II.A.1 (New York: United Nations, 1971)

Application of Computer Technology: Report Prepared in Response to General Assembly Resolution 2804 (XXVI), Action Programme in Science and Technology for Developing Countries, No. E/C. 8/11/Add.1 (NY: UNESCO, 1973)

Arntz, Helmut, "Informationspolitik: Internationale Organisationen und Aktivitäten", in E. Lutterbeck, Dokumentation und Information (Frankfurt am Main: Umschau Verlag, 1971), pp. 269-276

Barquin, Ramon C., et al. "Model for Progress in Developing Nations", Datamation International, Vol.5, No.3 (Sept. 1976) pp. 190A-190H

Beltram, S., "Application of Computers and Computing Techniques to Developing Countries", background pages presented to UN Advisory Committee for the Application of Science and Technology to Development, 1971

Beresford, J., et al., Data for Development, Group III Synthesis Report (Marseille, France: Data for Development, 1975)

Commission des Communautes Europeennes, First European Congress on Documentation Systems and Networks, Luxembourg, 16-18 May, 1973 (Luxembourg: CCE, 1973)

"Conference on Information Networks in East Africa, 1973" UNESCO Bulletin for Libraries, Vol.28, No.1 (1974), pp. 52-3

Dakin, A.J., "Computer-Assisted Planetary Thinking", in P.K. Varma ed., Proceedings of the Third International Conference on Computer Communications (1976), pp. 588-593

Development of Documentation and Information Networks in East Africa--Proceedings of a Conference--East African Academy German Foundation for International Development, UNESCO, Nairobi, July 1973

Einhaus, H., Technological Transfer through Information: Scope and Limitations, ID/WG.103/4 (Vienna: UNIDO, 1971)

FID, Information Systems Design for Socioeconomic Development Proceedings of a Symposium, Brussels, Sept. 30 - Oct. 2, 1975 (The Hague: FID, 1976)

Frey, Frederick W., "Communication and Development", in Ithiel de Sola Pool, and Wilbur Schramm, et al., eds., Handbook of Communications (Chicago: Rand McNally, College Publishing Co., 1973)

Ganz, C., and J. Goldhar, "Role of Scientific Communication in the Process of Technological Innovation", Information: News and Sources (Oct. 1975), pp. 243-5

Hattery, L.H., Computer Technology in Developing Countries, Summary of a Symposium sponsored by AID, 22 - 23 March, 1973 (Washington D.C.: American University, 1971)

International Development Research Centre, The First 200 Projects (Ottawa: IDRC, 1974)

International Telecommunications Union, World Plan (Geneva: ITU, 1973)

Jones, G., The Role of Science and Technology in Developing Countries (London: Oxford University Press, 1971)

Kamman, A.B., "Development of Computer Applications in Emerging Nations", AFIPS Conference Proceedings - Fall Joint Computer Conference, Vol.39, pp. 17-26

Khan, M.N.G.A., "World Information Systems in a Developing Country", in IAEA, FAO, UNESCO, Information Systems, pp. 427-432

Kunz, Werner, and Horst Rithel, "A Low-Cost Off-Line Fulltext Service for Integrating Small Countries into International Information Systems", in FID, Participation, pp. 45-50

Larimer, Daniel, and Wilbur Schramm, eds., Communication and Change in the Developing Countries (Honolulu: East-West Center Press, 1967)

Lorenz, John G., "International Transfer of Information", in Carlos A. Cuadra and Ann W. Luke, eds., Annual Review of Information Science and Technology, Vol.4 (Washington D.C.: ASIS, 1969), pp. 379-402

Maggiolo, O.J., and J.P. Poliniere, Science Policy and Information Systems in the Andean Countries (Paris: UNESCO, 1973)

Masuda, Yoneji, "Management of Information Technology for Developing Countries", presented at the XX International Meeting of the Institute of Management Sciences, June 1973

Nanus, B., and H. Borko, "The Social Implications of the Use of Computers across National Boundaries", Proc. 1973 Nat. Computer Conference, pp. 735-745

National Academy of Sciences, Scientific and Technical Information for Developing Countries, TA/OST-AN-72-4-1 (Washington D.C.: NAS, 1972)

On Cooperation for the Development of Information Systems in Developing Countries, Technological Systems Development Research Report No.48-5 (Tokyo: Mitsubishi-Chase Manhatten Consulting Co., Ltd., 1975)

Page, John, Possibilities in the Networking of Scientific and Technical Information in Developing Regions, "Prepared for the UNESCO/UNISIST Programme", 1976

Parkhill, D., "Computers and Telecommunications", in Pipe and Veenhuis, National Planning (1976), pp. 428-438

Pipe, G. Russell, "Technological Independence through Informatics Alliance", in Pipe and Veenhuis, National Planning (1976), pp. 50-56

Pipe, G. Russell, and A.A.M. Veenhuis, eds., National Planning for Informatics in Developing Countries: Proceedings of the IBI International Symposium, Baghdad, 2 - 6 November, 1975 (Amsterdam, New York, Oxford: North-Holland Publishing Co., 1976)

Policies for the Application of Science and Technology to Development (Ithica, NY: Cornell University, 1973)

Pool, Ithiel de Sola, "International Aspects of Computer Communications", Telecommunications Policy (Dec. 1976) pp. 33-51

Pool, Ithiel de Sola, et al., Communications, Computers and Automation for Development, Report UNITAR-RR-6 (NY: UNITAR, 1971)

Pool, Ithiel de Sola, et al., Low Cost Data and Text Communication for the Less Developed Countries (Cambridge, Mass.: Research Program on Communications Policy, MIT, 1976)

Sherrod, John, ed., Information Systems and Networks: Eleventh Annual Symposium, March 27 - 29, 1974 (Westport, Ct.: Greenwood Press, 1975)

Shinebou, J., "United Nations...Documents and Mechanization... Idea for a Minimal Information Service in Developing Countries", Int. Libr. Re., Vol.6, No.2 (1974), pp. 121 ff.

Simmons, R.A., Guidelines for the Use of Computer Technology in the Developing Countries, Interim Report NBSIR 73-423 (Washington D.C.: National Bureau of Standards, 1973)

Society of Technical Communications, Proceedings of the 22nd International Technical Communication Conference, Anaheim, California, May 14-17, 1975 (Tarzana, Calif.: Univett, Ive, 1975)

"South-East Asia Information Network", FID News Bulletin, Vol.23, No.12 (Dec. 15, 1973), p. 156

Szentivanyi, T., "Facilities Rendered by Computer Networks to Developing Countries", in Workshop on Data Communications, September 15 - 19, 1975, CP-76-9 (Laxenburg, Austria: IIASA, 1976), pp. 163-7

"Telecommunications: Applications for Social Needs", ASIS Bulletin (June 1975), pp. 10-17

Tell, Björn, "Regional Co-operation in Information", UNESCO Bulletin for Libraries, Vol.30, No.3 (1976), pp. 130-139

Tocatlian, Jacques, "International Information Systems", in Melvin J. Voigt, ed., Advances in Librarianship, Vol.5 (NY: Academic Press, 1975), pp.1-60

UNESCO, Committee on Science and Technology for Development, "Technology Assessment and Perspectives; Appropriate Technology; Research and Information for Developing Countries: Computer Science and Technology", in CSTD, Report of Second Session, New York, NY, 11 - 29 March, 1974 (NY: UN, 1974), pp. 22-26

"UNESCO to Spend $1.9 Million on Science Information Services", Information: News and Sources (Nov. 1975), p. 263

Vagianos, Louis, "Library and Information Associations in the International Arena", International Library Review, Vol.6, No.3 (July 1974), pp. 241-251

Werdel, Judith, "CISTIP Established within the Academy", Bulletin of the American Society for Information Science, Vol.1, No.3 (1974), p. 8

Wilson, John H., Jr., ed., A World of Information: Proceedings of American Society for Information Science, Vol.9, 35th Annual Meeting, Washington D.C., 23 - 26 October, 1972 (Westport, Ct.: Greenwood Press, 1973)

World Bank, Telecommunication: Sector Working Paper (1971)

MATCHING PROBLEM AREAS AND TECHNOLOGIES (SPECIFIC)

Agricultural Marketing Information Services in Latin America... Report of a Technical Conference...FAO. Lima, Pisa, Dec. 1969

Callahan, Rose E., "Developing a World Trade Information System", Special Libraries, Vol.66, No.12 (1975), pp. 575-8

Caponio, Joseph F., and Leila Moren, "AGRIS", Science, Vol.187, No.4173 (Jan. 24, 1975), pp. 233-236

Clippinger, John H., Who Gains by Communications Development? Studies of Information Technologies in Developing Countries, Working Paper 76-1 (Cambridge, Mass.: Program on Information Technologies and Public Policy, Harvard University, 1976)

"DEVSIS", FID News Bulletin, Vol.26, No.4, (1976), pp. 47-8

Furtado, A., "International Cooperation in the Field of Educational Information: The Role of the International Bureau of Education", UNESCO Bulletin for Libraries, Vol.29 No.5, (1975), pp. 249-254

"International Activities", Bibliography Documentation, Terminology, No.6 (1974), p. 311

International Development Information Service (DEVSIS) Steering Committee, First Session, Paris, France, Oct. 16 - 18, 1974, Final Report, (Paris: UNESCO, 1974)

International Development Research Center, OECD, UNESCO, Recommendations of the Meeting on the Feasibility of an International Information System of the Development Sciences (DEVSIS) (Ottawa: IDRC, 1974)

"International Referral System: The Exchange of Environmental Information", FLC Newsletter (Washington D.C.) No.89 (October 1975), pp. 2-3

Knox, W.T., "A Network for Technological Information Transfer in Developing Countries", in IAEA, FAO, UNESCO, Information Systems, pp. 417-425

Lester, Lois Joy, Comp., A Directory of Sources of Assistance on Educational Technology for Development, Report ICIT-6 (Washington D.C.: Information Center on Instructional Technology, Academy for Educational Development, Inc., 1975)

Mayer, William J., et al., "A Quick Systematic Method for World-wide Patent Awareness", Journal of Chemical Information and Computer Sciences, Vol.16, No.2 (1976), pp. 76-7

Moore, D.W., "Introducing Computers into Public Administration in Less Technologically Developed Countries", in A.B. Frielink, ed., Economics of Informatics, (New York: North-Holland, 1975)

Muller, Mervin E., "Challenges in Using Computers in Statistical Applications in Developing Countries", Int. Stat. Rev., Vol.44, No.2, (1976), pp. 249-263

National Academy of Sciences, Systems Analysis and Operations Research: A Tool for Policy and Program Planning for Developing Countries (Washington D.C.: NAS, 1976)

Podirac, B. de, "Mise en Place d'un Systeme International d'Echange d'Information sur la Politique Scientifique et Technologique: Systeme SPINES", in IAEA, FAO, UNESCO, Information Systems, pp. 93-99

Participation of Small and Less Developed Countries in Worldwide Documentation Activities and Information Exchange ...Proceedings of the FID Int. Cong.: Federation Int. de la Documentation, Budapest, Hungary, Sept. 1972

Samuelson, Kjell, et al., Global and Long-Distance Decision-Making, Environmental Issues and Network Potentials (Stockholm: 1971)

Technotic/Worldtech: A Global Marketing System for the Exchange of Technology (Minneapolis, Minn.: Control Data Corp., 1975)

Tocatlian, Jacques, "International Information Systems", in Melvin J. Voigt, ed., Advances in Librarianship, Vol.5 (NY: Academic Press, 1975), pp. 1-60

Turkov, Zh., and A. Chepkasov, "Planning and Development of INIS: Its Application of UNISIST Principles and its Interconnection with other International and National Systems", in IAEA, FAO, UNESCO, Information Systems, pp. 15-34

Turoff, Murray, "Computerized Conferencing for Developing Countries", Field W Fie, 1974, No.13

"UNISIST International Information Centre for Technology", UNISIST Newsletter, Vol.1, No.1 (1973), pp. 7-8

UNISIST: Study Report on the Feasibility of a World Science Information System (Paris: UNESCO, 1971)

UN Advisory Committee for the Application of Science and Technology to Development, Technology Appropriate for Industrial Development, E/4967

UNIDO, Seminar on Industrial Information (For Latin American Countries), Lima, Peru, September 13 - 24, 1971, Draft Report, Part I, ID/WG.103/6 (Vienna: UNIDO, 1971)

United Nations Environment Programme, Earthwatch: The International Referral System for Sources of Environmental Information (Nontechnical Description) (Nairobi, Kenya: D.L. Patel Press, 1975)

Verduin-Muller, Henriette, Tele-Blackboard: The Contribution of New Media to Education in Developing Countries (Utrecht, Netherlands: Utrecht State University, 1972)

Woolston, John E., DEVSIS: A Development Sciences Information System (Ottawa: International Development Research Centre, 1974

Woolston, J.E., "International Information Systems: Their Relation to Economic and Social Development", in IAEA, FAO UNESCO Information Systems: Their Interconnection and Compatibility, Proceedings of a Symposium, Varna, Bulgaria, 30 Sept. - 3 Oct. 1974 (Vienna: IAEA, 1975), pp. 51-60

World Federation of Engineering Organizations, Report of the Conference on Engineering Information in Developing Countries, April 22 - 26, 1974, Cairo, Egypt (London: Committee on Engineering Information, WFEO, 1974)

World Federation of Engineering Organization, Committee on Engineering Information, Conference on Engineering Information in Developing Countries, Cairo, Egypt, 22 - 26 April, 1974, Report (London: WFEO Secretariat, Institution of Electrical Engineers, 1974)

Wysocki, A., "UNISIST Programme: Its Role in International Co-operation in Scientific and Technical Information", in IAEA, FAO, UNESCO Information Systems, pp. 3-13

- PROBLEMS IN INFORMATICS AND DATA EXCHANGE

Aborn, Peter K., et al., "Supplying Machine-Readable Data Bases to Users outside the United States", in John H. Wilson, Jr., ed., A World of Information, pp. 97-103

Adelman, I. and C. Morris, Economic Growth and Social Equity in Developing Countries (Stanford, Calif.: Stanford University Press, 1973)

Allen, Thomas J., et al., "The International Technological Gatekeeper", Technology Review, Vol.73, No.5 (March 1971) pp. 3-9

Aubrac, R., "AGRIS: Problems de Compatibilite et d'Interconnection", in IAEA, FAO, UNESCO Information Systems, pp. 35-40

Baron, Christopher G., "Computers and Employment in Developing Countries", International Labour Review (May/June 1976) pp. 329-44

Bloch, Uri, "Is it Technology that Impedes Information Network Development?", in John H. Wilson, Jr., ed., A World of Information, pp. 65-70

Burchinal, Lee G., "Notes from OSIS", ASIS Bulletin, Vol.1, No.1 (June/July 1974), pp. 5+

Bussel, C., ed., Computer Education for Development: Proceedings of the Rio Symposium on Computer Education for Developing Countries, 6 - 12 August, 1972 (1972)

Chakhmakhchev, A.G., "UNIDO-UNESCO Inter-Regional Courses on Industrial Information for Developing Countries (USSR, Moscow, 1970-72)", UNESCO Bulletin for Libraries (July 1973) pp. 194-8

Cooney, Sean, and Thomas Allen, "The Technological Gatekeeper and Policies for National and International Transfer of Information", R & D Management, Vol.5, No.1 (Oct. 1974), pp. 29-33

East, H. and M.T. Martinelli, Building on What Exists: The Development of AGRIS as an Example of Systems Interconnection IAEA-SM-189/4 (Vienna, Austria: IAEA, 1974)

East, Harry, "The Preliminaries to International Collaboration", in John H. Wilson, Jr., ed., A World of Information, pp. 3-8

Fassi-Fihri, A., "Mise en Place d'Infrastructures d'Informatique Compatibles, en Particulier dans les Pays en Voie de Developpement", in IAEA, FAO, UNESCO Information Systems, pp. 401-407

Goldstein, Harvey, "Does Asia Need Computers?" Singapore Trade and Industry (Nov. 1972), pp. 35-37

Gonod, Pierre, and James Beverly, "Constraints on the International Flow of Information in Latin America", in Wilson, World of Information, pp. 219-228

Harpainter, Robert E., Defense vs. Development Risks in Exporting Technology (Carlisle Barracks, Penn.: Army War College, 1975)

International Council of Scientific Unions, "Selected Sections from Study on the Problems of Accessability and Dissemination of Data for Science and Technology", Information: News and Sources (July 1975), pp. 169-77

Joyce, C.C., "National Policies and International Computer Networking", ASIS Bulletin (Nov. 1975), pp. 14-15

Lohner, W., "Standardization and Compatibility Issues in the UNISIST Programme", in IAEA, FAO, UNESCO Information Systems, pp. 365-370

Menou, Michel J., "Specific Cost-Benefit Aspects in the Design of Information Systems in Less Developed Countries", in Helen J. Waldron and F. Raymond Lond, eds., Proceedings of the American Society for Information Science, Vol.10, 36th Annual Meeting, Los Angeles, Calif., October 21 - 25, 1973 (Westport, Ct.: Greenwood Press, 1973), pp. 145-6

Mickelson, Sig, "Communications Satellites: A New Channel for International Communications, a New Source of International Tension", presented at 57th Annual Meeting of the Association for Education in Journalism, San Diego, Calif., August 18 - 21, 1974

Noble, James E., International and Technology Transfer: Who Safeguards Our Technology (Carlisle Barracks, Penn.: Army War College, 1975)

Okolie, Charles C., Legal Aspects of the International Transfer of Technology to Developing Countries (NY: Praeger, 1975)

Page, John, "International STI Networks: Promises and Problems", Bulletin of the American Society for Information Science, Vol.2, No.4 (1975), pp. 12-13

Robredo, Jaime, "Problems Involved in Setting Up and Operating Information Networks in the Developing Countries", UNESCO Bulletin for Libraries, Vol.30, No.5 (Sept/Oct. 1976), pp. 251-255

Vajda, E., et al., "International Standardization as the Main Precondition for the Development of International Information Systems with Special Regard to INIS and Similar Co-operative Systems", in IAEA, FAO, UNESCO Information Systems, pp. 353-364

Werdel, Judith, "International Programs Issues", ASIS Bulletin, Vol.1, No.1 (June-July 1974), pp. 5+

Werdel, J.A., "Ten Commandments for International Cooperation", ASIS Bulletin (Nov. 1975), pp. 11+

APPENDIX C

RESEARCH AREA AND ISSUE
RATING PROCEDURES AND RESULTS

WORKSHOP EVALUATION SUMMARY

INSTRUCTION SHEET SENT TO PARTICIPANTS

IIASA International Data Exchange Task
Workshop Follow-Up 1977

Rating Schemes for Major Areas of Attention in International Data Exchange and Selected Critical Issues

Two basic rating schemes will be used in this exercise. First, the major areas identified during the Toronto Workshop will be rated according to your opinion as if you were allocating an international research effort over an extended period of time (more than five years). You are allocated 100 points to distribute across the five major areas. Second, you are asked to rate specific issues according to your opinion regarding their overall urgency with respect to research activities and then, for IIASA, their appropriateness for attention during the next year.

The first rating focuses on the areas of international data exchange identified during our Toronto Workshop which are as follows:

SAMPLE	Allocation of 100 Points
o User Identification and Needs Analysis	30
o User Training for Data Use	20
o Economic Factors (including who will own data; potential for manipulation of data for economic ends; and impacts on jobs, balance of payments, and information infrastructures, for example)	15
o Privacy and Security Factors	20
o Competition and Conflict Nationally and Internationally (including politics, culture, ideology, and economics for example)	15
TOTAL	100 Points

The second dual rating scheme addresses specific issues and involves the following scales:

Urgency with respect to overall need of research in this area:

1 Not urgent at all
2 Not very urgent
3 Moderately urgent
4 Urgent
5 Extremely urgent

Appropriateness for IIASA to address during the next year:

1 Not appropriate at all
2 Not very appropriate
3 Moderately appropriate
4 Appropriate
5 Extremely appropriate

A Sample set of ratings for an issue follows:

ISSUE	URGENCY	APPROPRIATENESS FOR IIASA
5. Evaluation of methods of payment by user for information - is it a free good after payment of transmission costs, or is there to be a charge for the data itself in some instances?	4	2

To help you with the "appropriateness" rating the following statement of IIASA objectives should be considered:

"IIASA should address problems of international importance leaving for others matters of strictly national relevance. Problems of international importance may be global -- that is, they cross national boundaries, involve inherently more than one nation, and cannot be resolved without the joint action of more than one nation; or they may be universal -- that is, they lie within the boundaries of single nations and can be resolved by their individual actions, but are shared by almost all nations."

In addition, IIASA's proper role "is a comprehensive approach ... IIASA's goal is to analyze international problems ... in a comprehensive way, identifying and investigating the interrelationships among the pieces of the overall problem." (Excerpted from the enclosed Address by R. E. Levien titled "Applying Systems Analysis in an International Setting", May, 1976.)

NOTE:

The values appearing on the following forms are the composite results of the 16 responding workshop participants. For each item two values are presented: (1) the average value and (2) the standard deviation (appearing in parentheses).

IIASA International Data Exchange Task
Workshop Follow-Up 1977

Rating of General Research Areas in Promotion of International Data Exchange

	Area	100 Points to be Allocated Across Following Areas According to Personal View of Overall Priorities
1)	User Identification and Needs Analysis	24.5 (9.4)
2)	User Training for Data Use	12.4 (9.0)
3)	Economic Factors (including who will own data; potential for manipulation of data for economic ends; and impacts on jobs, balance of payments, and information infrastructures, for example)	27.3 (11.4)
4)	Privacy and Security Factors	15.6 (5.1)
5)	Competition and Conflict Nationally and Internationally (including politics, culture, ideology and economics, for example)	20.2 (7.9)
	TOTAL	100 Points

IIASA International Data Exchange Task

Workshop Follow-Up 1977

List of Issues for Ranking

(Note: Issues appear in random order)

	ISSUE	URGENCY*	APPROPRIATENESS FOR IIASA*
1.	Determination of which data sets are now best organized and how they are most easily accessed.	3.4 (1.3)	3.7 (1.3)
2.	Study of how data charges are to be calculated and levied.	2.6 (1.0)	2.1 (1.0)
3.	Study of how standards should be set for international data exchange including at the technical level (existing international standards groups) and at the human or natural language level.	3.3 (1.4)	2.9 (1.0)
4.	Study of the process and outcome of standard-setting activities for data exchange.	2.9 (1.0)	2.6 (1.2)
5.	Evaluation of methods of payment by user for information - is it a free good after-payment of transmission, cost, or is there to be a charge for the data itself in some instances?	2.7 (.9)	2.5 (1.0)
6.	Evaluation of need for data exchange programs to be imbedded within larger programs of technology transfer in order to survive.	3.5 (1.2)	3.7 (1.2)

*Rate on scale of 1 - 5 for least urgent from an overall viewpoint and least appropriate for IIASA attention to most (see rating instructions, Attachment 1).

	ISSUE	URGENCY*	APPROPRIATENESS* FOR IIASA
7.	Evaluation of the importance of "technique" versus "technology" in promoting data exchange.	1.8 (.9)	2.4 (1.3)
8.	Study of why past efforts at data exchange have failed or succeeded and development of techniques for identifying these factors.	3.4 (1.0)	3.6 (1.3)
9.	Study of the potential misuse of data (e.g. satellite data on crop forecasts) by larger nations in manipulation of economies of developing nations.	3.1 (1.1)	2.9 (1.2)
10.	Study of organizational structures most appropriate for international data exchange programs and determination of application dependency of these structures.	3.4 (.9)	3.9 (1.1)
11.	Study of different methods for establishing and defraying cost components for data exchange activities.	2.7 (1.1)	2.5 (1.1)
12.	Determination of need for a mixture of exchange activities to justify the cost of individual exchange programs.	2.3 (.8)	2.9 (1.0)
13.	Study of methods of justification of data exchange activities to political bodies having power of approval and support of such activities.	2.9 (1.4)	2.9 (1.3)
14.	Evaluation of how information on exchange facilities can best be disseminated to the widest possible audiences.	3.3 (1.1)	3.8 (1.1)
15.	Identification of the common national problems in data communications which relate to successful international data exchange activities.	3.7 (1.0)	3.7 (.9)

*Rate on scale of 1 - 5 for least urgent from an overall viewpoint and least appropriate for IIASA attention to most (see rating instructions, Attachment 1).

	ISSUE	URGENCY*	APPROPRIATENESS* FOR IIASA
16.	Study of methods used by developing countries in acquiring and using data (with a focus on future techniques).	3.5 (.8)	3.3 (1.1)
17.	Study of how developing countries do now and/or can in the future take advantage of international exchange activities.	3.7 (.8)	3.5 (1.0)
18.	Development of improved framework for conceptualizing data exchange activities (to be applied to establishment of activities and training for use of activities, as well as methodology for global systems design).	3.3 (1.3)	3.9 (1.2)
19.	Systems analysis of institutional infrastructures and their impact on exchange activities (does not include hardware or data base content evaluation).	2.8 (.9)	3.6 (1.3)
20.	Identification of the users of data in exchange programs and determination of how their needs can best be identified and translated into a useful service.	3.5 (1.1)	3.1 (1.2)
21.	Study of users of international data exchange products to determine effect of homogeneity/ heterogeneity of this user population.	2.9 (1.1)	3.1 (.8)
22.	Identification of the major barriers to exchange programs, (in terms of magnitude of the barrier and also type of exchange activities impacted).	4.1 (1.1)	3.8 (1.0)

*Rate on scale of 1 - 5 for least urgent from an overall viewpoint and least appropriate for IIASA attention to most (see rating instructions, Attachment 1).

	ISSUE	URGENCY*	APPROPRIATENESS* FOR IIASA
23.	Study of the impacts of international data exchange on the emigration of information processing activities out of particular countries and the impacts of this on employment and balance of payments (for example).	3.1 (1.4)	3.0 (1.3)
24.	Analysis of the investments in telecommunications and economic growth at national levels.	3.1 (1.5)	3.0 (1.3)
25.	Study of access methods to data bases with an emphasis on compatibility.	2.5 (.7)	2.9 (.9)
26.	Estimation of start-up costs for "typical" exchange programs.	2.7 (.7)	2.4 (1.0)
27.	Study of methods of evaluating the quality of data to be exchanged.	2.6 (.8)	2.6 (1.0)
28.	Development of methods for identification of priority areas for exchange programs and implementation of these methods at an international level.	3.3 (.7)	3.7 (1.2)
29.	Determination of how directory of data bases should be compiled, distributed, and maintained including what data are where.	3.3 (.8)	3.5 (1.2)
30.	Study of the reasons for success or failure of organizations already working in the area of international data exchange and identification of the roots of the successes or failures.	3.6 (.9)	3.7 (1.2)

*Rate on scale of 1 - 5 for least urgent from an overall viewpoint and least appropriate for IIASA attention to most (see rating instructions, Attachment 1).

	ISSUE	URGENCY*	APPROPRIATENESS* FOR IIASA
31.	Identification of what international communication and information services are now available and evaluation of their effectiveness.	3.6 (1.2)	3.6 (1.0)

Additional issues you would like included (please rate)

a) _____ _____

(See following page for issues added here by participants)

b) _____ _____

c) _____ _____

*Rate on scale of 1 - 5 for least urgent from an overall viewpoint and least appropriate for IIASA attention to most (see rating instructions, Attachment 1).

Additional Issues Suggested by Panelists at Time of Issue Rating

(Urgency and Appropriateness Factors are not averages but values assigned only by panelist submitting that issue)

	URGENCY	APPROPRIATENESS FOR IIASA
Training needs for effective data utilization	4	5
International role of availability of data and computer conferencing for crisis resolution - e.g. famine	5	5
International role for planning related to global issues - e.g. population migration in developing countries	5	5
Trans-border data flow problems, including tariffs, language, etc.	4	4
Intercept of data flow - overt covert, mischance	3	3
National requirements for participation in international data exchange	3	3
Determination of whether developing nations should get preferred rates, including no charge, for use of either the network or data	4	4
Determination of the rules that will govern the general availability of the transferred information after it is deposited at a facility in the receiving nation	3	5
Legal implications	3	3

PARTICIPANT FEEDBACK
IIASA WORKSHOP ON
INTERNATIONAL DATA EXCHANGE
TORONTO
7 AUGUST 1977

(Total of 16 Respondents)

1. Do you feel that the goals of the workshop were adequately expressed in the preliminary material mailed to you?

Yes 13 No 3

Comment: 1- On travel when material arrived, felt should be mailed soon.
1- Felt real goals only evident in meeting
1- Goals too ambitious for one day

2. Do you agree with the goals of the workshop. (If not please suggest alternate goals for a future workshop on this topic).

Yes 15 No 0

Comment: 1 non response

3. Was the preliminary material mailed to you helpful in preparing for this workshop?

Yes 13 No 3

Comment: 1- On travel (see question # 1)
1- No reason
1- More background material including institutions and projects currently focusing on area was needed.

4. Do you think the workshop achieved its stated purpose?

Yes 13 No 3

Comment: 1- Structured model not developed
1- See comment on need for more background - Question # 3
1- Needed more 'direction' from IIASA. More intergroup discussion at early stage to clarify objectives.

5. What, if anything, did you dislike about this type of workshop?

Comment:

See list on following page

6. What did you like about the workshop?

Comment:

See list on following page

7. Would you be willing to participate in further meetings on this topic at IIASA?

Yes 15 No 1

Comment:

"No" response felt topic interesting, but cost of travel/time difficult to justify.

8. Please provide the following information:

NAME/TITLE _____

MAILING ADDRESS _____

_____

TELEPHONE _____

TELEX _____

Return to:

W. D. PENNIMAN
IIASA
Schloss Laxenburg
A-2361 Laxenburg
Austria

Responses to Questions 5 + 6 of Workshop Participant Evaluation

(This is a condensation, some responses appeared several times in different forms)

Question 5: What, if anything, did you dislike about this type of workshop?

One day was not enough time to accomplish the workshop objectives.

Smaller group at the workshop would have been more condusive for brainstorming.

Workshop should have had Eastern European participants.

Topic was too diffused.

Participants seemed unprepared for the workshop approach.

More options for IIASA research areas should have been presented to participants prior to workshop.

Question 6: What did you like about the workshop?

Workshop was open and informal, but still retained a structure.

Appreciated opportunity to meet other individuals in same area and exchange ideas.

Concept of helping IIASA to plan future reseaach programs is good.

Free and open exchange of ideas even though many divergent viewpoints were present.

Organization and structure of workshop with results-oriented approach.

Opportunity for each participant to make an introductory statement.

APPENDIX D

DATA ANALYSIS PROCEDURES

Data Analysis Procedures

During the workshop follow-up the participants were asked to provide quantitative evaluations of the general areas and specific issues generated during the workshop of 7 August 1977. Of the nineteen workshop participants sixteen responded to the follow-up questionnaire and rating form. The IIASA staff members at the workshop were not included in this follow-up data collection.

General Research Areas

The five areas (user analysis, user training, economic factors, privacy/security, and competition/conflict) were evaluated by asking the participants to apportion 100 points across the areas as if they were apportioning an international research effort over an extended period of time (more than five years). This represented a measure of their personal view of the overall priorities over the long term. The data were summarized by averaging the weights of the 16 responses for each of the areas and also by computing the standard deviations by means of the formula:

$$S = \sqrt{\frac{\Sigma X^2 - N\bar{X}^2}{N - 1}} \qquad (1)$$

In addition to the mean and standard deviation computed for each of the five areas the median and distribution was also checked for unusual data distributions. In all cases the median and mean were quite close.

Specific Research Issues

The thirty-one research issues were evaluated on two dimensions by the workshop participants. These were:

(1) urgency with respect to overall need for research in this area and (2) appropriateness for IIASA to address this issue during the next year. In each case the participants were asked to use a five-point interval scale with 1 representing least urgent or appropriate. The scales were devined as follows:

URGENCY	APPROPRIATENESS
1. Not urgent at all	1. Not appropriate at all
2. Not very urgent	2. Not very appropriate
3. Moderately urgent	3. Moderately appropriate
4. Urgent	4. Appropriate
5. Extremely uegent	5. Extremely appropriate

and the scales were assumed to be of the equal interval type.

For each issue the total number of responses for each dimension was computed. One respondent provided partial responses for three issues and no reponse for five other issues. Three respondents provided no reponses for one or more issue. In all, eleven issues had less than sixteen complete responses. In no case were there less than 14 responses for any one issue.

The mean and standard deviation for each issue was computed for each dimension using the exact number of responses for that issue and equation (1) for the standard deviation. The results of these computations are presented in Appendix C. The standard deviation ranged from .7 to 1.5.

The screening and selection of most urgent and most appropriate issues was done according to the following protocol:

a) For all issues with urgency or appropriateness weight above 3.0 -

b) Rank issues by urgency weight.
c) Rank issues by appropriateness weight.
d) Select the top ten issues in the urgency list that also appear in the list of issues with an appropriateness weight $\geq$ 3.0.
e) In the case of additional issues having an urgency weight equal to the tenth issue selected, include all ties.
f) Select the top ten issues in the appropriateness list that also appear in the list of issues with an urgency weight $\geq$ 3.0.
g) Handle ties some as the step e.
h) Select intersection of the two sets resulting after steps e and g (i.e. all issues appearing in both of the final screening lists).

This procedure resulted in the final selection of issues which were not only most appropriate for IIASA to undertake, but also high on the urgency scale. In addition it provided an intermediate result of the most urgent issues or the most appropriate issues for IIASA as well as the most urgent issues not necessarily appropriate for IIASA (see Tables of Chapter II).

Issues versus Areas

The comparison of issue evaluation to overall area evaluation as discussed in Chapter II and shown in Table 4 was done in the following manner:

a) Each issue was assigned to one of the five general areas judged most appropriate for it by the IIASA research team.
b) The average weights with respect to urgency and appropriateness were computed for the sets of issues within each area.

c) The total number of issues assigned to each category was evaluated as well as the average weight of issues as opposed to the overall weight of the area (see Table 4 of Chapter II).