# INTEGRATING
# IN LIBRARIANSHIP
# INFORMATION

*ABSTRACT*

*Library education all over world is under many pressures, which are enumerated. The paper concentrates on the relation between subject of librarianship, the subject of information science and the accommodation of information science in library education. Library education needs to take into account advances in information science because they provide neva theoretical frameworks and new professional services. The emergence and domain of information science is briefly reviewed. The content of three areas of work in information science is discussed: (i) professional (applied, practical), (ii) technological and (iiil scientific (basic). Efforts and problems in information science education are reviewed, particularly as trated in library schools. Recommendation are given for integration of library and information science curricula and work in general.*

*Tefko Saracevic*
*School of Library Science*
*Case Western Reserve University*
*Cleveland, Ohio 44106*
*U.S.A.*

*Descritores: Educação em Biblioteconomia; educação em Ciência da Informação.*

## 1 INTRODUCTION

Library education all over the world is under many pressures, such as:

- to upgrade curricula and courses, particularly to correct fragmentation, **fill** gaps and introduce more rigor;
- to accommodate teaching of new areas, particularly those that involve information science and information technology;
- to provide for new orientations and job requirements, particularly those involving library and information networks, library automation and systems analysis;
- to respond to needs for professionals for information services in many specialized fields, such as health sciences, agriculture, chemistry, industry etc. where there are great pressures of exponential growth of literature, where there are many forms of hard-to-access information and where qualitative information services are directly linked to development, to research, to social, technical, scientific and economic advances;
- to respond to needs for professional oriented toward provision of services to large segments of population that have little or no contact with libraries and information services, e.g. urban population, children etc;
- to respond to requirements for creation of managers, particularly allround information managers and not only library administrators;
- to engage in research, to lead rather then follow;
- to create competent faculty that may be able to respond to these demands;
- to provide for continuous education and upgrading of already working professionals.

All over the world in library schools, in developed and in developing countries changes in curricula are being made or contemplated. Tradicional library education is being modified. Many of those that

* *Trabalho apresentado à Reunion Interamericana de Bibliotecários y Documentalistas Agrícolas, San José, Costa Rica. 10 - 14 de abril de 1978.*

graduated five or ten years ago have a feeling that they are missing something. However, all these implemented or contemplated changes are by no means an easy proposition. They are not universally agreed upon. They are controversial; at times they are superficial and cosmetric rather than substancial. They do present problems worth a pause for rethinking.

The degree of the enumerated pressures at various places may differ but these pressures are universal. Even in the countries where the demands are to create a basic infrastructure of library and information services such educational pressures exist, because of the demands for quantum leaps — to incorporate basic as well as most advanced services, to serve broad population segments with very basic library needs as well as engineers, scientists, managers and professionals having sophisticated needs for internationally available information that require most modern information services.

Recognizing all these pressures and aspects, I wish to concentrate in this paper only on the relation between the subject of librarianship and the subject of information and the accommodation of information science in library education. On one hand, library education needs take into account advances in information science because they provide new theoretical frameworks and new professional services. On the other hand, information science education needs to take into account accumulated library knowledge and wisdom, to prevent reinvention of the wheel and to utilize a philosophical framework tested over three millennia.

## 2 EMERGENCE AND DOMAIN OF INFORMATION SCIENCE

The incubation stage of what is to emerge as information science, started in the 1930"s and intensified in the 1940's with the ideas and suggestions that modern information technology should be applied to control and search of scientific and technical literature as an answer to very practical problems of 'information explosion'. Scientific and technical information was considered important for strong science and technology, which in turn was considered as essential for economic growth, development and national secutiry — thus many countries chose to support work on the resolution of problems of scientific and technical information.

Information science emerged and grew along side similar "communication disciplines", such as new information technology, computer science, information theory, cybernetics, semantics, new linguistic and logical theories, game theory and general systems theory (1). It borrowed and used practical and technological achievements from these and other fields as well as broader theoretical conceps ant ideas, as such exchanges are common among fields, particularly when it comes to sciences. Theoretical works of Shannon, Wiener, Chomsky, Von Neuman, Turing and others has effected emergence and evolution of information science. In other words, from the outset there were not only practical concerns, that is concerns with professional services and technological applications, but along side there were also scientific concerns, that is concerns with theoretical explanations and experimentation to serve as a broader framework and base for practice. The reason for this duality is simple: in chemistry, eletronics, medicine and many other fields it was demonstrated time and again that the power of connection between theory, experimentation and practice is most fruitful for all and the people working os information science took this as a model.

A number of definitions of information science have emerged — probably the most quoted is the Hayes/Borko/Taylor definition (2):

> "Information science is that discipline that investigates the properties and behavior of information, the forces governing the flow of information and the means of processing information for optimum accessibility and usability... It has both a pure science component which inquires into the subject without regard to its application and an applied science component, which develops services and products".

More recently, Goffman addressed the scientific domain of information science as follows (3):

> "Information science must address all observable facts and events relating to the notion of information. Thus, information science must be an organized body of knowledge based on explanation principles which seeks to discover and formulate in general terms the conditions under which facts and events relating to the generation, transmission and use of information occur".

Thus in information science three directions emerged:

(i) *professional* (applied, practical) — concerned with information systems, services and networks, first in science and technology, but later in many areas as well.

(ii) *technological* — concerned with utilization of information technology, particularly computers, micrographics and telecommunication technology to handling of information.

(Mi) *scientific* (basic) — concerned with theories and experimentation dealing with communication and information in a broader context than just scientific and technical information.

Next, I wish to discuss each of these three areas as they developed over time and finally as they are relevant to library education. The work in these areas was often clearly related to each other. It can be shown that the most important advances in information science are a result of a successful interaction between theoretical and experimental work on one hand, and professional practice on the other hand.

## 3 PROFESSIONAL (PRACTICAL) WORK IN INFORMATION SCIENCE

The professional work in information science evolved around information retrieval (IR). In the 1950's information retrieval systems began to emerge in the U.S., Europe and USSR and in the 1960''s in developing countries as well. In the 1970's international retrieval systems and networks are taking shape. The principles of information retrieval were formulated during the 1950's and early '60's to govern the activity to this day. The major principles include:

i) 'information,explosion' was defined as the basic underlying problem to which IR was responding.

ii) Relevance (i.e. retrieval of relevant information) and user orientation was taken to be the basic aim of IR systems; the testing measures, such as recall and precision, reflect this.

iii) Coordinate indexing was established as a method for information representation; most importantly coordinate indexing was also a method linking representation and retrieval of information (of rather documents); Boolean algebra was the theoretical foundation for retrieval rules — because of these well formulated rules computers could be successfully applied for searching and retrieval.

iv) Natural language emerged as the basis for information representation and thesauri (in various forms) as the basic tool for vocabulary control.

v) Information technology was taken to be an integral aspect of IR systems.

vi) Systems approach was taken as a method for analysis, design and operation of IR systems.

vii) Rules of demand (in terms of information needs) and supply (in terms of information resources) were taken as basic to justification of IR work and to economics of IR systems.

viii) Active provision of services, continuous exploration for new services and products and aggressive marketing was taken as essential to IR

As more elaborate IR systems and services' were developed, — involving machine readable data bases, on-line retrieval services, national and international networks, involvement of new areas and users, development of new tools (such as citation indexes) and new services (such as SOI, Selective Dissemination of /nformation) — these principles were elaborated in greater and greater detail, however, in their basic concept they still remain the same. However, applications in many new areas (such as in development or agriculture) and development of international systems (such as DEVSIS or AGRIS) have created specific norms, tools.analysis of user needs, approaches to handling information, thus, created specializations. And as with all specializations the problem of seeing the forest from the trees, the problem of fruitful interaction and adaptation became also a problem in professional work in information science and in education. To this day the problem has not been resolved, it even seems to becoming more acute.

IR systems are primarily concerned with communication of recorded public knowledge so are libraries. Thus, many of the principles, tools and services developed in IR have direct relation to that which libraries are driving at and doing.

## 4 TECHNOLOGICAL WORK IN INFORMATION SCIENCE

What is termed as 'information revolution' derives not only from spectacular developments in three traditional information technologies:

Computing technology — evolving from abacus to computers;

Signal transmission technology — evolving from smoke signals to telecommunications, radio TV, satélites;

Reproduction technologies — evolving from Rosetta stone to Gutenberg to Xerox and micrographics;

but even more so it derives from the successful marriage between these three technologies to most recent times. Results of the marriage are among other: on-line networks where computers may be on one end and users on another end of telecommunication networks computers may be on one end.and users on another end of telecommunication networks spanning continents; facsimile transmission; computer output microfimls (COM); computer controlled printing or word processing etc., etc., etc.

Information science did not develop only in relation to this technology. As mentioned, new professional principles and scientific insights were developed as well. However, application of the new information technology was and still is a major part and problem area of information science. It often seems that this technology is in position of the perennial perennial tail wagging the dog, rather than vise versa. That is, advances in technology are quite often dictating advances in applications. While technologies for manual retrieval were developed in information science (optical coincidence cards, edge-notch-punch cards, Uniterm cards etc) and while they still have many fruitful individual applications, primarily information science is trying to cope with effective and efficient utilization of the enumerated modern advances in information technologies.

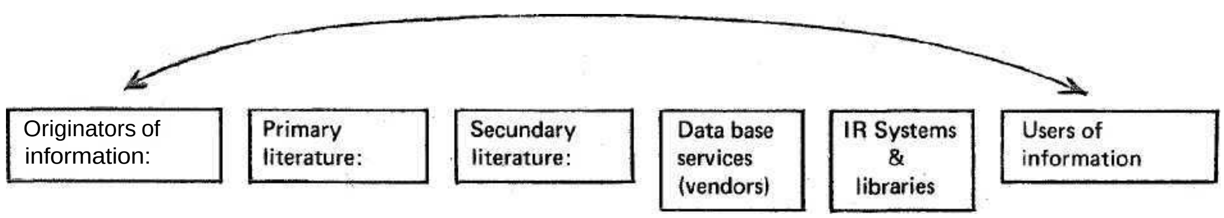
To this end many developments took place in or were adapted by information science, including;

- computer file organization methods — sequential, inverted, list and chain files.
- programming packages for processing, indexing, retrieval, library automation, etc.
- micrographic devices and standards particularly suitable for document processing and retrieval.

But probably the most important was the development of an information industry and national and international information networks. These also have the greatest potential impact on libraries and on the use of library resources.

## 5 INFORMATION INDUSTRY AND INFORMATION NETWORKS

Information industry and information networks involve a chain of processors some of them new, between originators and users of information. The chain can be represented as follows:




| | | | |
|---|---|---|---|
| e.g. authors, data compilers, etc. | journals, statistics, patents, etc. | e.g. indexes, abstracts, data base producers: - Chem. Abst. NLM AGRIS IMS | e.g. SDC Lockheed MEDLINE AGRIS INIS |

Machine readable data bases and data base services are new elements introduced in the chain primarily due to advances in information technology. Data bases proliferated rapidly: around 1970 there were only a few data bases, today there are over 300 covering a large number of fields and containing over 50,000,000 records. While machine readable data bases can be considered as a new of publishing of indexes, abstracts, statistics etc. — the data base services (vendors, networks of data bases) are an entirely new element for which no counterpart existed in the past. New principles and forms of international cooperation in creation and sharing of data bases such as pioneered by INIS (nuclear Information) and AGRIS (agricultural information) proved to be workable and beneficial for all involved.

Use of these data base services is more and more finding its way in libraries, not only in developed but also in developing countries. However, one of the problems is document delivery — nothing is more frustrating for users than to retrieve a potentially useful citation and not be able to get the document itself. It is here where the importance of good library resources and/of resource sharing looms very large. It is here where libraries, data base services and information centers are allies, fully dependent on each other.

## 6 SCIENTIFIC WORK IN INFORMATION SCIENCE

As mentioned, ã number of scientific theories and experiments outside of information science provided and is still providing useful generalizations, models and starting points for explanation of phenomena and processes of interest to information science (e.g. information theory, cybernetics. Boolean algebra etc). Thus, through its scientific dimension, information science is finding a broader base and numerous connections.

Most of the scientific work in information science in the 1950's and 1960's was on theories, models and experiments concerning process *within* IR systems, such as work in (reviewed in part in (6):

- models for indexing (e. g. probabilistic, associative) and for other information representations (e.g. classification, semantic road maps);
- linguistic models and indexing languages;
- document clustering, ordering, ranking, associating;
- file organization models;
- general logic for retrieval;
- question processing and search strategies;
- performance of retrieval systems — measures, tests;
- principles of systems analysis and design;
- feedback models retrieval systems (e.g. relevance feedback);
- human factors in systems (e.g. indexers consistency);

Associated was work on broader aspects, such as studies of user needs and studies on relevance and relevance judgments (7). Toward the end of the 1960's and particularly in the 1970's information science research broadened considerably to include study of phenomena and processes *surrounding* (or underlying) information systems in general (IR systems, information centers, libraries). For instance, this includes work on:

- communication theories, such as epidemic theory of communication (e.g. review (8).
- structure and dynamics of literature.
- bibliometrics — quantitative study of literature and its behavior (e. g. review (9).
- utility and economics of information.

The ultimate goal (dream?) of basic research in information science is to formulate a general theory of communication, to serve as a theoretical foundation .of the science of information. However, there are many serious practical problems that are in need of considerable research. One of these is the problem of quantity vs. quality. Data bases and associated on-line services which are at present the main stay of information industry and networks are oriented toward the control of quantity and not quality. There are no quality filters; to much is being retrieved, especially too much junk. As information requirements become more complex, as the size of literature and data bases grow and grow, the problem of quality becomes more acute. What are needed are smaller and quality based information systems and processes that can extract quality from quantity of documents and information. Possibly these new areas of research on phenomena and processes surrounding information systems may provide clues to the solution of quality problems. Furthermore, these broader areas of research have considerable relevance to libraries and library problems (for instance, bibliometric research has relevance to problems of selection or weeding of materials).

## 7 EDUCATION IN INFORMATION SCIENCE

First academic courses related to information retrieval appeared in the mid 1950"s. A decade later a number of courses and programs in information science were established in academic institutions in many countries. In addition, workshops, short and training courses, and institutes were organized in large numbers by national and international organizations. Educational developments were almost as rapid and unfortunately because of it, as fragmented and uneven as the professional and scientific developments in information science.

On the education front in information science the 1970's are witnessing:

- A further considerable increase in academic courses and programs devoted to information science, nationally and internationally. This includes the spread of education in information science to developing countries.

- An increase in the number of academic disciplines and departments that embraced information and certain aspects of information science, as one of their orientations.

- A closer involvement, even integration, between the traditional library curriculum and information science curriculum in a number of library schools. This is particularly evident in the practical, technical areas-library automation, networking, on-line services, etc. An ever larger number of library students in all library specializations, are taking information science courses.

- Emergence of information science as an integral, and even basic academic part in a number of Ph. D. programs in librarianship as well as in computer science.

- A gradual and unfortunate loss of the relation between research and teaching in information science. This relation was a hallmark of the information science education in the 1950's and 60's.

The majority of information science courses and programs are located within library schools (or closely affiliated with such schools). However, courses and programs appeared in other schools and departments computer science departments, management schools, education departments, and in some instances in subject departments such as psychology, philosophy, pharmacology (drug information programs) etc. In a few relatively small number of cases, independent information science schools or departments appeared as well.

As the 1970's are drawing to an end, information science education is confronted by a series of issues that need study and resolution (10). These issues are related among others to problems of jurisdiction and academic homes, re-focusing of objectives, restructing of curricula and contents. Demands for graduates with different and deeper knowledge and professional skills are increasing — professional graduates that will manage information and information services in many forms and academic graduates that will expand work on research problems. Thus, while library education is looking toward ways of further integration of information science in its programs, information science education itself is in the process of soul searching and changing. Needless to say that this complicates matters.

## 8 INFORMATION SCIENCE IN LIBRARY SCHOOLS IN NORTH AMERICA

Here are some statistics about information science teaching in the 58 accredited library schools in the U.S. and 6 in Canada (derived from counts in (11) and a resent survey (12):

- Only one out of the 64 accredited library schools does not have any courses in information science

- Average number of courses in information science offered by library schools is four; about a dozen schools have comprehensive information science programs.

- The 64 schools have all together some 730 full time and 630 par time faculty members; of these 180 full time and 60 part time are teaching information science courses; 13 schools have only 1 full time information science teacher; 9 schools have 40% or more of their faculty teaching information science; the highest school has is 11 information science teachers.

- Twenty-four library schools offer a Ph. D. program — about a dozen of there have information science as one of the Ph. D. specializations.

From surveying library school catalogs Fosdick (12) grouped information science courses in library schools into five areas:

i) *Library Automation:* use of modern technologies, particularly computers in library operations; courses are tipically application oriented. Over 80% of schools have courses in library automation.

ii) *Information Retrieval:* modern IR systems and related topics, both theoretical and practical. Included are: information representation (abstracting, indexing etc.), controlled vocabularies (thesaurus etc.), question analysis and searching methods, dissemination methods, comparison and evaluation of different IR systems. There are a number of advanced courses dealing with single topics from the preceding. Some 80% of schools have courses on these topics.

iii) *Systems Analysis:* modern systems concepts, analysis, design, systems engineering. Also courses containing statistical studies and quantitative methods for evaluation of library operations and services i.e. library effectiveness courses. Some 50% of schools have courses in these topics.

iv) *Interactive Computer Systems — Information Networks:* machine readable data bases and on-line retrieval systems, services and networks (e. g. SDC, Lockheed, BRS, MEDLINE, OCLC, BALLOTS). Data base structure, searching, query languages, comand languages. These represent the newest type of courses that emerged during the past few years. Some 30% of schools have courses on these topics.

v) *Programming.* Exclusive attention to programming languages and methodologies. File structures. Languages (as PL/1) particularly oriented toward library applications. Only some 10% of schools teach programming.

From my own surveying wish to add a sixth area of information science courses provided in library schools:

vi) *Communication:* broader theoretical and environmental aspects of information science. Included are: communication theories; bibliometric laws and methods, literature studies; user studies and methods; issues in different communication environments; etc. Maybe some 10% — 15% of schools have courses in these topics.

There are no data on what percent of students in library schools are exposed to these courses, but it is evident that the percentage is increasing. Still there is a large percent of library school graduates from schools where some of these courses were offered that never took any information science courses, that were never exposed to any of information science. And many are regretting this, particularly with the advent of on-line information networks (including those networks used for cataloging).

## 9 SUMMARY AND CONCLUSIONS

Librarianship and information science share an interest in the phenomena and processes of communication of recorded public knowledge and in problems of effective availability, accessibility and utilization of information. Thus, education for librarianship should provide for teaching of topics derived from theoretical, professional and technological works in information science. Each needs the other. I wish to suggest that information science topics that ought to be integrated in library education include (given in no order of priority):

Theoretical and experimental aspects of communication and of structure and dynamics of subject literatures.

Information retrieval systems, methods and services.

Information networks, national and internacional.

Systems analysis and design.

Information technology.

Library automation.

What is the relevance of all this to developing countries? Information is increasingly recognized throughout the world as a resource, which together with physical, economic, manpower and technical resources is needed for development of a country and a society. In particular this relates to information in scientific, technical and related fields. In other words, creation, procurement, organization, dissemination and use of proper information is such a vital part of development of a country and any segment of a society that without these there is no development. Thus, library education should respond no matter where, to the information needs for development. Part of this response has to do with integration of education in librarianship and information science.

## REFERENCES

1 — HARMON, G. *Human Memory and Knowledge: A systems Approach Greenwood, Westport,* Conn. 1973.

2 — BORKO, H. Information Science: What Is It? __*American Documentation,* 18(4): 197-208, October 1967.

3 - GOFFMAN, W. On the Phenomena of Interest to Information Science. Paper presented at the International Research Workshop on the Theoretical Basis of Information Science, Westfield College, London, England. August 1975.

4 - VAN RIJSBERGEN, C.J. File Organization in Library Automation and Information Retrieval, *Journal of Documentation,* 34 (4) 794 - 817, December 1976.

5 - WILLIAMS, M. The Impact of Machine-Readable Data Bases on Library and Information Services. *Information Processing and Management, 13:95-107, 1977.*

6 - ROBERTSON, S.E. Theories and Models in Information Retrieval. *Journal of Documentation,* 33(2): 126-148, June 1977.

7 - SARACEVIC, T. Relevance: a Review of and a Framework for the Thinking on the Notion in Information Science. *Journal of the American Society for Information Science, 26 (6): 321-341, November-December* 1975.

8 — MEADOWS, A.J. *Communication in Science.* London Butterworths, 1974.

9 - NARIN, F. MOLL, J.K. Bibtiometrics. In: *Annual Review of Information Science and Technology - M. Williams ed. vol 12.* Washington D.C. Knowledge Industry, p. 35-58. 1977.

10 - SARACEVIC, T. Information Science Education in the 1980's *Preceding of the American Society for information Science Annual Meeting,* vol 14 ASIS, Washington, D.C. p. 21 and microfilm 8-B7.

11 — Directory of the Association of American Library Schools *Journal of Education for Librarianship.* Special issue 1977.

12 — FOSDICK, H. Library Education in Information Science. Special Libraries, 69 (3): 100 - 108, *March 1978.*

RESUMO

Relação entre a biblioteconomia, a ciência da informação e o enquadramento da ciência da informação no ensino da biblioteconomia. Os progressos da ciência da informação contribuem para um quadro teórico e novos serviços profissionais. A emergência e abrangência da ciência da informação são abordadas sucintamente. O conteúdo das três áreas de trabalho em ciência da informação é discutido: (i) profissional (aplicada e prática), (ii) tecnológica e (iii) científica básica. Os esforços e problemas do ensino em ciência da informação são revistos, especialmente no tratamento dado, a esse ensino, pelas escolas de biblioteconomia. Recomendações para a integração curricular e geral da biblioteconomia e da ciência são feitas.

# PANORAMA

## PRESIDÊNCIA DO CNPq

Por *decreto de 15* de março do corrente ano, o Presidente da República nomeou os Doutores MAURÍCIO MATOS PEIXOTO e LINOOLPHO DE CARVALHO DIAS para exercer os cargos de Presidente e Vice-Presidente do Conselho Nacional de Desenvolvimento Cientifico e Tecnológico (CNPq)

Or, Maurício Matos Peixoto, é o segundo a ocupar o referido cargo desde que a instituição foi transformada em fundação. Exerceu interinamente! a presidência do CNPq, em 1974, tendo sido Vice-Presidente no período de 1971 a 1974, quando autarquia federal Vice-Presidente da Academia Brasileira de Ciências, desde 1967, é membro da Sociedade Brasileira de Matemática e da Academia de Ciências de São Paulo. Livre docente pela UFRJ, defendeu na ocasiâo a tese "Princípio* variacionais da mecânica", É membro do Conselho Técnico e Científico do Instituto de Matemática Pura e Aplicada (IMPA), cargo que vem ocupando desde 1968. Participou da Consultaria Cientifica do CNPq, desde 1975 até sua designação para apresidênciadesse Conselho. Autor de vários trabalhos publicados, tanto no Brasil como no exterior, participou, ainda, de conferências e cursos um diversos países.

Dr, Lintiolprto de Carvalho Dias, Vice-Presidente do CNPq, foi até à data de sua nomeação para esse cargo, Diretor do Instituto de Matemática Pura e Aplicada (IMPAI, direção essa que vinha exercendo desde 1965. Professor catedrático do Instituto de Matemática da UF RJ, obteve a livre docência com a tese "Formas diferenciais exteriores e sua aplicação à dinâmica". Foi consultor da Universidade de Brasília, Setor de Matemática, de 1962 a 1964, tendo participado, no rnesmo período, do Conselho Deliberativo da CAPES. Pertence é Sociedade Brasileira de Matemática, é membro do Conselho da Comissão Pulbright, bem como membro da Comissão Executiva permanente do Comitê Interamericano para Educaçüo em Ciência e Cultura da OEA. Possui vários trabalhos publicados, tendo participado, também, de conferências e congressos no País e no exterior.

## 2ª REUNIÃO BRASILEIRA DE CIÊNCIA DA INFORMAÇÃO

O Instituto Brasileiro de Informação em Ciência e Tecnologia - IBICT; unidade subordinada do Conselho Nacional de Desenvolvimento Científico e Tecnológico - CNPq, fez realizar no período; de 04 a 09 de março do corrente ano, no Centro de Convenções do Hotel Glória, no Ria de janeiro, a 2ª Reunião Brasileira de Ciência da Informação.



A Reunião que é promovida de dois em dois anos, como parte de seu prograrna de pesquisa, ensino e execução de atividades de informação *científica* e tecnológica contou com a participação de cerca de 700 (setecentos) especialistas brasileiros e estrangeiros.

O tema central da Reunião "Informação Científica e Tecnologia — Energia para o Desenvolvimento ', foi apresentado objetivarão, principalmente, avaliar o desenvolvimento do Brasil na área de Informação em Ciência e Tecnologia, assim como, coletar subsídios para orientação quanto à uma política nacional de ICT.

O Temário foi desenvolvido sob a forma de Painéis *: Temas Livres, que versaram score os seguintes temas

Toma 1: Infra-Estrutura - Iníormação, Ciência e Planejamento
Tema 2; Estrutura
Tema 3: Sistemas de Informação: Utilização e Disseminação
Tema 4: Tecnologia da informação

Nos Painéis 28 (vinte e oito) expositores apresentaram trabalhos, sendo 7 (sete) do Tema 1, 8 (oito) do Toma 2, 7 iseto) do Tema *3 e* 6 (seis) do Tema 4,

Nos Temas livres, 60 (sessenta) trabalhos foram expostos e debatidos, sendo 12 (doze) do Tema 1, 10 (dez) do Tema 2, 26 (vinte e seis} do Terna 3 e 12 (doze) do Tema 4.

Paralelamente.à Reunião, foi realizado um Painel Internacional sobre a "Informação em Ciência e Tecnologia para os Painéis em Desenvolvimento", que contou com a participação de diversos países da América Latina, Europa, América do Norte e África.

O Painel Internacional abordou os seguintes assuntos:

- As Necessidades específicas de Informação em Ciência e Tecnologia para os Países em Desenvolvimento.

— Inter-relacionamento dos Sistemas Nacionais com *as* Internacionais.

- Intercâmbio de ICT entre os Países em desenvolvimento.

- Sistemas Nacionais e Regionais de ICT.

Ainda: como parte do Programa em paralelo, se montou uma exposição técnico-científica que